THE

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(J. A. Berly's).

1914 EDITION

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OUR DUTY.

THE peace of more than half a century has been broken, and we find ourselves at war with a hitherto friendly nation to which we are bound not only by the ties of kinship, but also by the bonds of an immense volume of reciprocal trade, and by the pursuit of common aims and aspirations. The Continent of Europe has been shaken to its foundations, and war, unprecedented in extent, and, we fear, in horror, rages between five great nations. It is useless to repine; every possible effort was exerted by our statesmen to prevent the disaster which has overtaken the European peoples, but in vain, and for weeks, or it may be months, the gigantic struggle between the mightiest armies that the world has ever seen will continue, drenching the soil with blood. The strain is too terrific to be endured for long, though he would be a bold prophet who would undertake to forecast its duration; neither is it possible to predict the consequences of so vast an upheaval—but that they will be fundamental and world-wide cannot be doubted. The effects of the struggle will be felt for generations, and the whole course of civilisation—if a state of things which permits of wholesale carnage can be called such—will be changed.

In the midst of these unparalleled conditions there is but one honourable course of action open to every Briton, and that is to obey the call of duty—whether it lead him to the field of battle or to the less glorious but no less worthy occupation of the humble greaser. The nation is dependent upon trade and industry, not only for its prosperity, but also for its very livelihood, and those of us who are not needed for the defence of the nation's interests must put forth every effort to maintain the greatest possible volume of trade and thus secure continued employment for the bread-winners of our country. Fortunately there is no lack of food-stuffs within our borders, and no reason to anticipate the interruption of our supplies of food and of the raw materials of industry. The markets of the Continent are closed to us; the rest of the world is open, and the demand for goods hitherto obtained from the Continent will be diverted largely to our shores. Hence there should be no lack of work to do, and it is the plain duty of non-combatants to "carry on" with redoubled energy and application. Thus, while we shall not avoid we shall minimise the evils of the world-war and the sufferings of our industrial population. We have no wish to make capital out of the misfortunes of our neighbours; we seek only to lighten the burden of trouble and sorrow that is about to be laid upon our own people.

The Government have declared their intention of adopting every possible means to ensure the continuance of trade and industry, and though for a time abnormal conditions will obtain, due to the calling-out of the Reserves, the embodiment of the Territorial Force, and the use of the railways for military purposes, we believe the dislocation of internal affairs will be but temporary. In this respect we are vastly more favourably situated than the Continental nations, whose workmen have been called out practically *en masse*; but whether that is a matter for congratulation is somewhat questionable—had we possessed an army of a million men, the war might have been prevented. Our thanks are due to the members of the Territorial Force, who have voluntarily prepared themselves for the defence of our shores.

We cannot close this article without a reference also to our fellow-craftsmen—the Electrical Engineers—who have

devoted their leisure to military training, and are now called upon to bear their share, working searchlights for coast defence, laying field telegraphs and telephones, and helping in numerous other ways, as they did so well in the South African war. All honour to them for their patriotic self-denial. Nor should we fail to express our thankfulness that by the aid of wireless telegraphy, for which we are so largely indebted to Mr. Marconi, it is now possible for our Admiralty to maintain continuous communication with the fleets no matter where they may be engaged. But for the regrettable incidents which occurred two years ago, the Imperial wireless chain might have been far advanced towards completion; the emergency so contemptuously scouted by politicians has already arisen. Fortunately it is not likely, so far as can be seen at present, that our cable communications will be interrupted, or that we shall feel the want of the wireless service to India, South Africa and Australia—but we may do so before the curtain is rung down upon this most lamentable scene in the world's history.

Lead.

All through the financial panic which entailed the closing of the London Metal Exchange and most other trading institutions throughout Europe and in parts of North America, lead held firmly on its course with hardly a flicker. Since our last writing on the metal, there has been some abatement on the whole of the extreme tension of supplies, and prices have fallen below the parity of America, hence no further business worth considering has been done in Europe in United States lead. Nevertheless, however, there is still American metal ready to be sold if circumstances allow, and if prices recover somewhat. America is not a willing seller of lead at anything below £19 5s. London terms, and this price has to be obtained for pretty early shipment if sales are to be made.

The trade buying was on quite a fair scale until all business was stopped by the war panic abroad, and by the financial crisis. It is possible that the war conditions on the Continent may mean that quantities of lead which have been going direct to Germany and Russia will in future be diverted to British ports, in which event an entirely changed set of conditions will be set up from those ruling recently, but the drift in such a contingency would be to ease down the position from the point of view of consumers, whose efforts to keep themselves fully covered, when they have left over the replenishment of their needs till the last moment, have on many recent occasions had the result of driving up prices sharply. There can hardly be any violent export demand for immediate shipment of lead, now that war conditions are in full force on the Continent, so that the home trade will find the field pretty much to themselves so far as can be gathered at the moment. There has been a certain amount of American lead coming in against old contracts, and a little more is due to arrive, but otherwise there is no feature calling for special attention.

The resumption of smelters in Mexico is a most important factor bearing upon the United States situation, for even without Mexican raw material available, the United States has been actually selling domestic lead to the export markets; hence the resumption of shipments of Mexican silver lead to United States refineries must increase the amount of soft lead which these will have available for disposal either at home or abroad. Meantime, for the present all market conditions are subservient to war influences, and the future is past all human knowledge.

Owing to war conditions, the metal markets have now been closed for several days, and a very limited business is being done. As we go to press we learn that the Government has practically secured the option on all the lead now available in this country, and leading dealers intimate that they are not prepared at the moment to make sales to private consumers. In view of all the circumstances, it will be understood that the market is now exceedingly firm, and probably round about £20 a ton is a nominal quotation for prompt deliveries. We may add that considerable purchases of antimonial lead have been made by the authorities within the last few days.

Engineers and the War.

A letter appears in our "Correspondence" columns to-day suggesting that British electrical engineers should form a committee to collect the names of those who are willing to serve their country in the present crisis. A still better suggestion has since come to hand, from a member of the Institution of Electrical Engineers who desires to remain anonymous, in the form of a letter addressed to the Secretary of the I.E.E., as follows:—

Having regard to the extent and importance of Military and Naval services involving electrical and mechanical engineering, and to the present state of public affairs, I suggest that the I.E.E. should open a register of members able and willing to take temporary Government service; and put that register at the disposal of the Government. I enclose a suggested draft of the statement of particulars which should be on the register.

Temporary Government service; mechanical and electrical engineers. Offer, with personal and professional particulars:—

I, ..., am able and willing to entertain proposals for temporary service under H.M.'s Government, in services involving engineering duties.

Signed .....

Name in full; postal address; age; notice required; single or married; No. of dependent children; health; physical defects; occupation; employer; professional status; practical experience; military, naval, or marine experience and status; experience in control of men; languages; service offered for; specially qualified for.

We cordially commend this proposal to the notice of our readers, many of whom, we feel certain, will be anxious to place their skill and experience at the disposal of the Government in this hour of supreme trial of the nation's strength. It will not be forgotten, of course, that the London Electrical Engineers Territorial Force provides the necessary organisation so far as London is concerned.

A Curious Workman's Compensation Case.

Those who are wont to follow the reports of workmen's compensation cases are accustomed to anomalous and extraordinary decisions. In one County Court the Judge will appear to strain every nerve to find in favour of the working man; in another attention is sometimes paid to the pleas put forward on behalf of the employer. Further, inasmuch as the opinion of a County Court Judge is final on a question of fact, a search through the records of the Courts discloses numerous decisions which appear to be diametrically opposed! Of all the orders which are made adversely to the interests of employers, perhaps the most irritating are those which go by the name of "suspensory awards." The liability to pay is kept open by means of a nominal or practically nominal payment, which can be increased at any time on application to the Court should it be shown that the injured man has become less capable of working. To have a large number of suspensory awards in his pigeonhole is a very nice little asset to the solicitor who does a workmen's compensation practice. Every now and then he can set a few little applications on foot, and run up some nice little bills of costs. An extraordinary attempt to obtain a suspensory award has recently been brought to our knowledge. A wireman who was temporarily employed by the London Electric Railway knocked the skin off his knuckles. He took no notice of the injury, except that he reported it. Three days later he was discharged, and he subsequently suffered from blood poisoning, for which he claimed compensation. The employers consented to pay the full amount, namely, half wages, which came to 20s. a week. Notwithstanding that they were doing all that they were compelled to do by law, a claim for compensation was made against them in the County Court. The Judge actually made an award, but we are glad to find that the Court of Appeal overruled him. As the Master of the Rolls pointed out, no question had ever arisen under the Act, nor could it arise, so long as the employers continued to do all that was required of them.

The City and the Crisis.

The City of London faced the war situation calmly and collectedly. There was no trace of panic when a dozen firms were hammered in the Stock Exchange last week. There was no violent excitement in the money market when the Bank of England raised its minimum rate of discount from 4 per cent. to 8 per cent. last Friday, following this with an increase to 10 per cent. on Saturday. Rhapsodies of the half-penny-a-line order can be left safely to quarters which rarely betray their trust; it is sufficient for the plain man of affairs to state, and to read, that the attitude of the City throughout the present crisis has been one of calmness and self-possession.

Stock Exchange markets had been severely mauled for weeks prior to the outbreak of hostilities. The Ulster crisis in itself had been a standing menace for months past, and the volume of speculation had shrunk sensibly from what it is in normal times. The Austro-Servian quarrel provoked uneasiness, but little worse; and it was not until Austria practically declared war upon Servia last Saturday week that Stock Exchange and money markets grew perturbed.

Not even then was it supposed that the difficulties would lead to actual fighting. The Bank of England put up its discount rate from 3 per cent. to 4 per cent. upon the increasing rumbles of the war spirit in Germany and Russia. Before the Stock Exchange settlement took place, business in securities had marched to an abrupt standstill. In Consols it was still possible to deal; in a few Home Railway securities there remained a mockery of a market; in Brazilian Tractions some people dealt at margins of 5 points between the buying and selling quotations.

Seven failures occurred on pay-day. The Paris Bourse postponed its monthly settlement for another month. Some London firms who had heavy engagements to meet on behalf of German and French clients made no secret of the certainty that they would have to hammer themselves. The Stock Exchange Committee, however, saved the immediate situation by closing the House last Friday, and closing it until further notice. With the Bank Holiday extended until Friday in this week, a week's breathing space has been given; and the London Stock Exchange followed the French example by postponing until the end of the month the settlement which in the ordinary way would have taken place next week. Meanwhile, the Bank of England on Saturday, while the Stock Exchange was closed, raised its rate to 10 per cent., a rise of seven points within as many days; and the Bank Act has been suspended, which permits the issue of notes to a greater extent than is allowed in the ordinary way.

The Bank Rate, of course, is the charge made by the Bank for discounting bills of the highest grade. In other words, if a firm of unimpeachable standing had given another firm, of the same character, a bill for certain goods, the latter house could take it to the Bank of England and get the money straight away instead of waiting until the time when the bill became payable, the Bank of England charging discount at the Bank Rate of the day. The effect of this is to retain money in the country, although to show how this comes about might prove a tedious process for the reader. How extraordinary are the ideas prevalent with regard to what the Bank Rate really is, most people know. A dear old lady explained to us the other day that the effect of a 10 per cent. Bank Rate meant the deduction of half-a-sovereign from every five-pound-note when the note came to be cashed at the bank.

The effect of monetary stringency such as is reflected in a high Bank Rate is far-reaching and important. The delicate intricacies of credit, built up laboriously through so many years, become mere *culs-de-sac* when the imperative call is for gold. The commercial undertaking keeps a substantial cash balance at the bankers, but a much bigger reserve in securities available in the ordinary way for purposes of temporary loans; and if the structure of security be shaken, the base of gold upon which it is reared cannot be chopped up in sufficiently small pieces to go round.

The great money mart, after all, is the Stock Exchange; and the confidence of credit rests largely upon the fact that the proprietor of securities knows that he can sell these, and get the money within a fortnight, through the ordinary medium of Throgmorton Street. Close these avenues, and the community in general is up against a proposition unique in the memory of the present generation. To deal through other directions is a different matter from buying and selling beneath the protection of Stock Exchange rules and regulations. The sooner the Stock Exchange is open again, therefore, if only for cash transactions, the better might it be for everyone.

We venture to take the view—and this not merely as a personal one, but as reflecting into one focus the opinions literally of many dozens of City men experienced in the money and the stock markets—that although there may be a run on the banks, and although people will feel secure only when they have lined their safes with sovereigns, the situation will gradually clear itself, and currency conditions drop into the normal, perhaps within the course of a day or two. The worst, practically, is known; and it is not the worst, but suspense, which kills.

The calm and steady way in which London—speaking principally for the City and its financial organisations—has withstood the shock of the crisis is rational ground for assuming that no new alarm is likely further to unsettle it. The people who are laying in supplies of flour, of sugar, of condensed milk and so on, are in a large minority. Prices will rise, have already done so, in fact; but they are not likely to advance exorbitantly. Out of the evil, good will come. Canada and the United States, for example, may find their financial salvation by reason of the present grave condition of affairs. Afterwards there will arise such activity in trade, in metals, in stocks and shares, as few can remember. These, however, are for the future. The immediate outlook is too serious to be illumined by more than hope, but that hope is fortified and cheered by the steadfast way in which the financial institutions of the City of London, and the people whom they affect, have met a situation that might have precipitated a panic which nobody could have called surprising.

Electrical Trades Union Conference.—On Monday a special Conference of the Electrical Trades Union, which was expected to last the whole of the week, was opened at the Holyoake House, Manchester, for the purpose of revising rules. Mr. J. W. Ball, of Stockport, presided, and 80 delegates, representing 96 branches, were present. The chairman said that since the last Conference, three years ago, the membership had increased by 6,253, and was now 8,364. Appealing for solidity in the trade, Mr. Ball said they did not desire to have control of the electrical industry, but the sequence of events forced matters upon them, and they would have to control it, or someone else would. Before they could stop the influx of unskilled labour into the trade they would have to control that labour itself, and the only way to do it was to open the gates for them to enter and organise themselves after the ideas of the Union; otherwise they would either organise outside or continue to be picked up by other societies. That could be done without injustice to anyone or jeopardising their own interests, and they would protect their apprentice members at the same time. The Union embraced shipping, engineering, building, tramways, mines and maintenance work. Their aim ought to be to get absolute control of the industry and of every man engaged in it, so that no worker could be exploited to the detriment of others. Having completed their organisation, they must seek continuity of membership, and so settle for all time any disruption between branches.

An Electrical Engineer's Fee.—At the Liverpool City Council on July 29th, on the proceedings of the Tramways and Electric Power and Lighting Committee, Mr. Gates raised a question on the standing orders with regard to a payment by the Salford Corporation of 150 guineas to the electrical engineer for services rendered. He was against allowing their engineer to compete with private enterprise, and moved that the matter be referred back. Dr. Utting pointed out that it was a practice of municipalities to indulge in matters of that kind and allow their principal expert officers to advise for corporations. The standing orders expressly provided for an officer taking work of that kind, and the question of fees had never been one for the Council to deal with. Ald. Fred. Smith said the action of the Committee would be quite regular and proper. The amendment was defeated by a large majority.

D

OVERHEAD WIRES AND THE LAW.

[FROM A LEGAL CONTRIBUTOR.]

Among the legal queries addressed to the Editors of the Review, problems relating to the use of overhead wires are frequently to be found. The use of wires so placed is an obvious and inexpensive method of transmitting power from place to place. What, then, are the legal restrictions affecting this means of transmission?

The "common law" upon the subject may be stated to be that anyone who stretches a wire across the land of another without leave or licence is guilty of a technical trespass. Again, if wires are stretched along or across a street or highway, the person who puts them in that position does so at his peril, inasmuch as the public who are using the street are entitled to be protected against falling wires. But there may be circumstances in which a man owning land on either side of a highway has the right to stretch wires across it. In such a case he owns the surface of the "hard high road," and so long as the right of the public to pass and repass along it is not interfered with, he cannot (at common law) be prevented even by the highway authority from stretching his wires, whether they be for the purposes of telephone, telegraph or the transmission of energy.

By a process of evolution the Legislature has gradually placed restrictions upon the use of overhead wires. Prior to the Electric Lighting Acts the matter never assumed any importance, except in relation to telephone and telegraph wires with which we are not greatly concerned. The first Electric Lighting Act (1882), however, imposed restrictions upon the use of aerial cables. By S. 14 of that Act: "Notwithstanding anything in this Act or in any Act incorporated therewith, the undertakers shall not be authorised to place any electric line above ground, along, over, or across any street, without the express consent of the local authority, and the local authority may require the undertakers to forthwith remove any electric line placed by them contrary to the provisions of this section, or may themselves remove the same, and recover the expenses of such removal from the undertakers in a summary manner; and where any electric line has been placed above ground by the undertakers in any position a court of summary jurisdiction, upon complaint made, if they are of opinion that such electric line is or is likely to become dangerous to the public safety, may, notwithstanding any such consent as aforesaid, make an order directing and authorising the removal of such electric line by such person and upon such terms as they may think fit."

This section, however, was apparently found not to impose restrictions on the use of overhead wires. Accordingly it was further provided by S. 10 (*b*) of the Schedule to the Electric Lighting (Clauses) Act. 1899, that "The undertakers shall not, without the express consent of the Board of Trade, and, where the local authority are not themselves the undertakers of the local authority also, place any electric line above ground except within premises in the sole occupation or control of the undertakers, and except so much of any service line as is necessarily so placed for the purpose of supply."

In County of London Orders, and under the London Electric Supply Act, 1908, S. 15 (*2*), the consent of the County Council and of the Board of Trade is required, while in some of the Power Acts it is provided that in the case of rural authorities their consent shall not be unreasonably withheld, the Board of Trade being authorised to decide any difference (see *e.g.*, The Somerset and District Electric Power Act, 1903, S. 48).

Even where the necessary consents are obtained, the works are subject to the regulations prescribed by the Board of Trade in reference to aerial lines. Further, the undertakers cannot carry such lines over land not dedicated to the public use without the consent of the owner of such land. In doing so they would be guilty of a trespass. Thus in the case of *Levy v. National Telephone Company, Limited*, the plaintiff brought an action for damages for trespass by stretching wires over his house, and also for an injunction for the removal of the wires. The defendant company, in resisting an application for interim injunction, urged that some of the wires had been over the house in question for thirteen years and that the plaintiff had only been in occupation of it for a short time; and that there was no danger to the plaintiff's house in allowing the wires to remain until the trial. Day, J., granted an interim injunction directing the defendants within two months to remove their wires. On appeal this decision was affirmed by the Court of Appeal. (See *Times*, December 18th, 1897).

Nor does the consent or approval above mentioned excuse the undertakers from the consequences of neglect or falling wires. For instance, in *Watson v. Sunderland Corporation* (cited in Shiress Will's Law Relating to Electric Lighting, p. 100), in an action for damages for an injury suffered by the plaintiff through the fall of a "live" overhead wire, the plaintiff proved the fall of the wire and the injury. The defendants submitted that there was no evidence of negligence, the system having been inspected by the Board of Trade, and weekly by the defendant's employees. The County Court Judge left the case to the jury, who found negligence. On appeal, the Divisional Court, held that the judge was right in allowing the case to go to the jury.

The law, however, cannot be regarded as fully stated unless one deals with the rights of persons supplying electricity otherwise than in accordance with the provisions of a special act. In this respect the person who supplies electricity privately was formerly in a better position that a supply authority. It was held in *Finchley Electric Lighting Co. v. Finchley Urban District Council* (1903), I. Ch. 437, that where a company was supplying electricity privately they could not be prevented by a highway authority from suspending wires over a highway, having previously entered into an agreement with the frontagers on either side of the road in order to be allowed to fix the posts necessary for the suspension of the wires. The right there asserted is not, however, very likely to be of much more than academic interest in the future, having regard to the fact that the supply of electricity otherwise than by a supply authority is now virtually taken away. Thus by S.23 of the Electric Lighting Act, 1909, "Where in any area a local authority, company or person is authorised to supply electricity under Act of Parliament or under licence or Provisional Order granted under the Electric Lighting Acts, it shall not, after the passing of this Act, be lawful for any other local authority, company or person to commence to supply or distribute electricity within the same area unless such supply or distribution is authorised by Act of Parliament, or by licence or Provisional Order granted in terms of the Electric Lighting Acts: Provided that this section shall not prevent any company or person from affording a supply of electrical energy to any other company or person where the business of the company or person affording the supply is not primarily that of the supply of electrical energy to consumers.

"Provided also that this section shall not prevent any company, who, at the passing of this Act, are empowered by their memorandum of association to generate electrical energy from affording a supply to a railway company for purposes incidental to that company's undertaking other than the conveyance of public traffic."

The suspension of overhead wires in any position —even on private land, is subject to certain other

statutory regulations which are of considerable importance.

They must by virtue of the Electric Lighting Act, 1888, S.4 (I.), only be so placed in accordance with the regulations of the Board of Trade. Again, in London, their use is subject to the provisions of the London Overhead Wires Act, 1891. With regard to Urban Districts the Public Health Acts Amendment Act, 1890, contains powers to urban authorities to make by-laws for the prevention of danger or obstruction to the public from posts, wires, tubes, or any other apparatus stretched or placed above, over, along, or across any street, whether before or after the adoption of the Act for the purpose of any telegraph, telephone, lighting, railway signalling or other purpose.

These by-laws are not to take effect unless confirmed by the Board of Trade. It is necessary to observe that the Act of 1890 is an adoptive Act and is of no force until adopted. Moreover, the Act does not extend to any works of any undertaker within the meaning of the Electric Lighting Acts, 1882, to 1888, to which the provisions of those Acts apply.

It will be seen from what has been said above that to suspend wires in any position is a matter which is attended with some danger of legal consequences of an unpleasant character.

Wholly apart from the prospect of being interfered with by the authorities there is always the danger of proceedings for damage caused by falling wires. Our knowledge of the liability of those whose wires fall about and injure people must, of necessity, be largely derived from a study of the law relating to tramway companies, and it may be convenient to review some of the cases in which the liability of these bodies has been considered.

In the first place, it may be stated that by the Tramways Act, 1870, Sec. 55, which applies to every tramway company, it is provided that the promoters or lessees of a tramway (as the case may be) shall be answerable for all accidents, damages, or injuries happening through their act or default or through the act or default of any person in their employment by reason or in consequence of any of their works or carriages, and shall save harmless all road and other authorities, companies or bodies collectively and individually, and their officers and servants from all damages and costs in respect of such accidents, damages and injuries.

The above provision prevents a tramway company, when sued by a person who has been injured by a falling trolley wire, from raising the defence that they are protected from actions for negligence owing to the fact that they work under statutory powers. This was made clear in a number of accident cases. For instance, in *Sadler v. South Staffordshire, &c., Steam Tramways Co.*, 1889 (23 Q.B.D. 17), it appeared that an accident was caused by the company's car which ran off the line at a point where that line joined that of another system, over which the company had running powers. It ran off the line owing to a defect in the points at the junction, but it was not clear whose duty it was to repair the points. It was held that in any event the owners of the car were liable, because their statutory powers did not extend to authorise their running along the highway on a track which was in a defective condition. Again, in an Irish case, a tramway company were held liable for injuries caused by the worn and slippery condition of their track.

Where trolley wires are insulated, and there are no guard wires above them, a broken telephone wire sometimes makes contact with the trolley wire. The result is that serious injury is caused by electric shock. In these circumstances it appears upon the authority of a County Court Judge, that responsibility does not rest with the tramway company. In *Bedworth & Son v. The National Telephone Co.*, an action was brought against the company for the price of a horse killed by an electric shock. It appeared that a broken telephone wire which fell on the horse, had short circuited a trolley wire belonging to the South Staffordshire Tramway Company who were joined as defendants. The judge held that the telephone company were liable, as they had been guilty of a trespass in allowing their wire to touch that of the tramway company, and he made them responsible in damages.

Owing to a number of accidents which took place at Liverpool from the entanglement of broken telephone wires with trolley wires, the late National Telephone Co. brought forward a clause excluding them from liability in such cases unless it was proved that the escape of electricity was due to the fault of the telephone company. A clause of this kind appeared in the Tyneside Bill of 1901 and a number of others. (See Elec. Rev., August 23rd, 1901, p. 330).

In America it was held that where one defendant's wire carrying a dangerous current crossed that of the other defendant's carrying a harmless current, and there were no guards between them, then both defendants might be found guilty of negligence, where an accident occured owing to a contact of the wires (*Rowe v. N.Y. and N. J. Telergaph Co.* (1901), N.J. 48, At.I.Rep. 523): but it was otherwise where the contact was caused by the fault of the owners of the dangerous wire, owing to the slipping of the trolley pole of one of their cars, or where it was due to the fault of the owners of the harmless wire in suffering it to get out of repair (*Western Union Telegraph Co. v. Thorn*, 1894, 64 Fed. Rep. 287).

The question whether the person who sustains injury can be guilty of contributory negligence which will relieve the tramway company does not appear to have been decided in the English Courts. It is submitted that if a passenger on the roof of a double-decker were to deliberately grasp a naked trolley wire, or otherwise expose himself to danger in contravention of the notices and bye-laws of the company he could be found guilty of such contributory negligence, then the tramway company could be relieved. At any rate, the decisions of the American Courts could be cited in support of such an argument. In *Freeman v. Brooklyn Heights Railroad Co.*, 1900 (66 N.Y.S.I., 052), a company was held not to be liable when its guard wire had become charged and injured a boy who was walking on the girder of a bridge where he had no business to be, although it was the custom of boys so to walk. There is no contributory negligence, however, if the injured person is under duty to be where he is at the time of the accident, or where a wire is dangerously near a public passage, although the injury is caused by an unusual act on the part of the passer by.

It may be said, and with reason, that many of the cases above referred to do not particularly concern electric lighting authorities, inasmuch as the cables which they would suspend are higher up, subjected to no wear and tear, and are heavily insulated. The underlying principle, however, that the person suspending cables is liable for negligence applies with equal force to cables of this character.

Canada.—The Montreal City Board of Control and the Montreal Light, Heat and Power Co. have reached a deadlock on the question of street lighting. The company has quoted £32 10s. per lamp per annum for the centre of the city, where underground cables are to be used, while Mr. Parent, the Board's lighting superintendent, estimates that, by a municipal scheme, the price could be reduced to £22 10s. per annum. Mr. Parent has now submitted a report to the Board, in which he estimates the capital expenditure of such a scheme at £34,500, and the total annual expenditure at £10,820. Officials of the Board and the company are to meet shortly, and the matter will then be decided. *Financial News.*

A DIFFERENTIAL RELAY FOR HEAVY WORK.*

By HARRY E. DEY.

Some time ago the writer had occasion to use a differential relay that involved unusual requirements inasmuch as it had to be very sensitive, operating upon a small fraction of 1 per cent. of change in current, and was used for closing and opening a pilot motor circuit (0.0825 H.P.) every few seconds, the motor running in two directions.

A prominent electrical instrument manufacturer had previously reported that he could provide nothing, either special or from stock, to fulfil the conditions, as the design of his instruments necessitated that the spring should be a conductor, while the current requirements involved were too great for this service. Upon further investigation the writer came to the conclusion that it was necessary for him to design some device to be made in the shop. Before entering upon a description of the device built it may be well to give a general idea of the purpose for which it was intended.

A 40-H.P. motor of special design and construction was installed on a United States cruiser for steering purposes. This motor was controlled for speed, direction and stoppage by means of a field rheostat only. Mounted on a standard on the bridge of the ship was a bronze case which contained a small high-resistance rheostat (*a* in Fig. 1), which was operated by

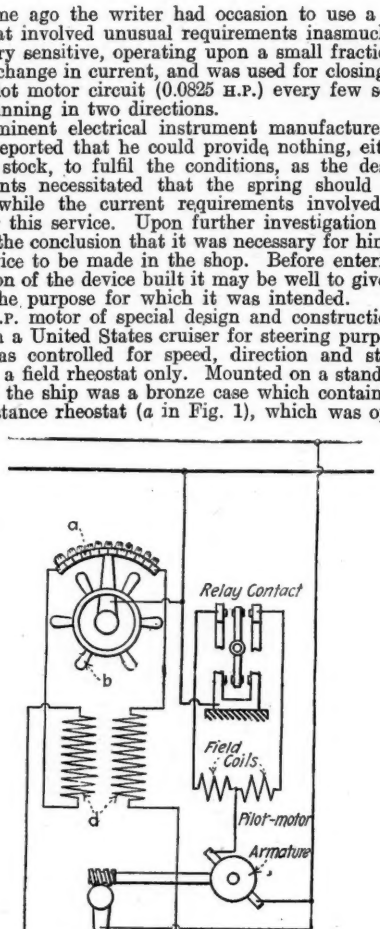


Fig. 1.—Control Circuits for Electric Steering.

means of a hand wheel *b*, the shaft of which was passed through the case. A line wire was connected to the contacting finger, which was normally at the centre of the commutating arc, thus giving equal resistance to each side. Down in the steering room a duplicate of this rheostat *c* was connected with the finger of the steering-motor field rheostat in a manner to cause them to move together. The differential relay was also installed in the steering room. Two wires connected the extremes of the arc of one rheostat to corresponding points of the other rheostat, the coils *d* of the differential relay being inserted in the circuits between the two rheostats in such a manner that the two windings opposed one another.

If the helmsman desired to turn the rudder, say, 5 deg. to starboard, he would turn the hand wheel until the index to which it was geared pointed to 5 deg. starboard. This would upset the equilibrium of the relay circuit, causing its pendulum to swing over to starboard and close the pilot-motor circuit. The latter would immediately operate, moving the arm of the field rheostat to a position that would cause the steering motor to run in the proper direction to carry the rudder to starboard. The pilot motor, besides changing the field rheostat, drove the contacting finger of the relay rheostat to a position which would neutralize the change of resistances in the rheostat on the bridge. This again balanced the two circuits, allowing the relay pendulum to swing to the centre and thus break the pilot-motor circuit. If the pilot motor overran by momentum, the relay would become unbalanced and thus swing over to the other side and reverse the motor. The overrun would be so short, however, that the motor would not have enough momentum on the return to pass over, consequently no brake was required. The net result was, therefore, a slight overrun, a rebound and a dead stop.

When the steering motor operates, in addition to moving the rudder, it drives, through a chain of gearing, the field rheostat body in the base of the machine. This rheostat body is driven in the same direction that the contact finger was moved, so that by the time the rudder has reached the end of its 5-deg. travel the relative positions of the finger and the body are unchanged from what they were before the helmsman acted. An overrun of the steering motor from momentum acts in a similar manner to that with the pilot motor, unbalancing the field rheostat and causing the motor to rebound with an easy elastic movement and to stop at the point required. It was interesting to watch this motor with its slow elastic movements for small changes and quick rotation for the greater rudder movements.

The relay, as illustrated herewith, is made from a brass spool 4 in. long and with heads 4 in. in diameter; the hole is 1.75 in. in diameter. After providing the proper insulation the spool was wound with two parallel insulated wires separated by a coarse thread. The four terminals were brought out to binding posts, which were later connected to the circuit in such a manner that the currents oppose one another. This causes a high difference of potential between the adjacent wires near their terminals, consequently extreme care is required in the winding. Each layer should be especially well insulated from the layer beneath. This parallel winding provides an absolutely accurate balance that can never be secured by winding the two circuits in separate coils. A brass shell slipped over the spool completes the metal housing. A hard-rubber plate is attached to one of the heads, for holding the binding posts, and the whole is fastened to a base plate by lugs as seen in Fig. 2.

Another brass spool was made to provide a snug fit in the first spool when forced in with its axis at right angles to the former. It is held from endwise movement by means of rods suspended from the binding-post plate which is mounted on top of the main spool. This spool is wound with a single insulated wire of a resistance sufficient to take care of the full line voltage, for it is connected directly across the circuit. A wide deep groove is cut across each head of this spool, extending lengthwise of the main spool. A soft-iron core, having considerable clearance within the hole of the spool, is mounted upon pivots at the centre, the clearance permitting a slight rocking motion up and down. This core is shouldered and threaded at the ends. An elliptically shaped ring is sprung over the ends of the core, when assembling, and held in place by thin iron nuts, the latter also serving as pole pieces.

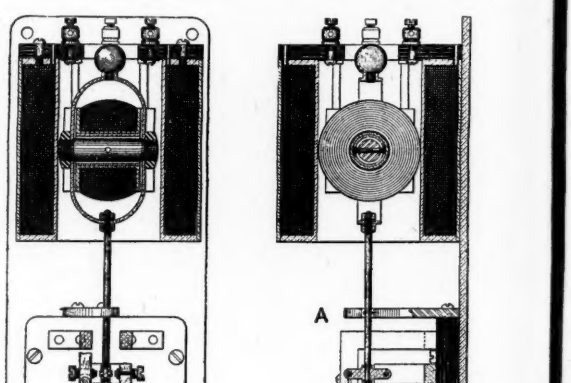


Fig. 2.—Construction of Differential Relay for Heavy Work.

It will be noted that none of the wires has any motion, and also that the iron core is traversed by a constant number of magnetic lines regardless of the balanced or unbalanced condition of the differential coils. In other words, it is equivalent to a permanent bar magnet, the only object of the winding being to obtain additional strength of magnetism. Owing to this fixed magnetism there is no magnetic lag and consequent loss of sensitiveness, as would be the case were the changing magnetism of a piece of iron depended on. With this design the slightest unbalancing of the currents of the outside spool is at once manifested.

A pendulum rod is attached to the lower part of the elliptical ring, while a ball serves as a counterbalance at the top. The lower end of the rod is turned off to form a shoulder and to provide a bearing for a bar about 1 in. long loosely mounted thereon. This bar is provided with platinum contacts, four in number, set upon opposite sides of its two ends. Corresponding contacts are set upon brackets mounted upon the base of the instrument. Two of these latter contacts are electrically identical, being attached to a bracket common to both. The double-contact bracket is connected directly to the line, while the single contacts are led to the pilot motor. The contact bar acts as a bridge between the double-contact bracket and one or the other single contacts, thus obviating any flexible connections between moving parts and also providing a double series break when opening the circuit. This greatly reduces the arc and also acts as a safeguard against sticking, for if one side did stick there would still be enough hinge action to allow the other side to open the circuit.

One problem that caused considerable difficulty was that of obtaining a spring to bring the pendulum to its neutral or

* From the *Electrical World*.

centre position and which would at the same time be practically frictionless. Another desirable feature in the spring was to have it decrease its pulling power as it left the neutral point so that by the time the contacts were reached there would be very little pull remaining, and thus the electrical contacts would be proportionately improved. These requirements are directly opposed to the principle of action of any mechanical spring, but the happy thought finally struck the writer of using a permanent steel magnet for a spring. The magnet included both the important elements of being frictionless and having the pull decrease with the distance moved, besides being easy to adjust by filing off the small wire used as an armature. The device as finally built consisted of a specially designed magnet, cut out of sheet tool-steel and hardened, of the form shown at A in Fig. 2. It will be noted that the pole pieces are sharply pointed, like the teeth of a saw, and are separated by about 0.25 in. The magnet is fastened to the insulating block in a position that will permit the pendulum to swing between the pole pieces without touching them. The pendulum at this point is drilled to receive a small iron wire, which passes through and is pointed at both ends. It is made short enough to afford a liberal clearance when passing between the poles. In operation the poles draw the iron wire, and hence the pendulum, to the exact centre and hold it there with all the force desired. This magnetic spring completely solved the problem, and it appears that there may be other cases where it might be used to advantage.

Before the sea trials the writer feared that the pendulum might vibrate, owing to the rolling and pitching of the ship and the vibration of the machinery, and thus keep up a continuous "seesawing" of the steering, for the magnetic spring had to be made quite weak in order to preserve the sensitiveness of the relay. But, as usually happens, the expected difficulty did not come to pass, and in the worst of seas the pendulum never wavered.

Another problem that came up in this steering device was that of reversing the pilot motor without the complication of a pole-changing switch on the relay. This was accomplished by providing the field with two sets of windings. Two terminals, one from each winding and of opposite signs, were joined together to one of the commutator brushes (see Fig. 1). Of the other two terminals, one was connected to one of the relay contact points and the other to the remaining contact. The other commutator brush was connected to the line. The resultant operation was that when the relay closed one circuit it sent the current through one set of field coils and thence through the armature in series. When the circuit was closed through the other contact the current passed through the other field coil in the reverse direction, which reversed the field, and thence through the armature in the same direction as formerly. This gives a reversing motor with only a single contact required for each direction. There are many cases where a control of this kind can be made to fit in to advantage.

The motor used was of standard manufacture and of the fan-motor type, but its builders refused to take any responsibility if they provided it with two fields. The writer lost patience with their ultra-conservatism, had the old field coils removed and replaced them with new ones of enameled wire. The saving in space due to using this enamel conductor in place of the former cotton-covered wire permitted almost as many ampereturns for each coil as there were in the original windings. The motor never gave the slightest trouble. Without any external resistance it was thrown on, back and forth, every few seconds, for periods sometimes extending over several days.

THE PRESENT STATE OF ELECTRICAL INDUSTRIES IN JAPAN.*

By Professor Shunkichi Kimura, Ph.D.
Consulting and Commercial Engineer for Electrical Industries and Applications, Tokio, Japan.

Home industry in Japan is progressing, but much more slowly than in Europe or America, and in the case of electrical industries Japan is from ten to fifteen years behind other countries in the West.

In the domain of electrical industries, water-power plants throughout the country are numerous and widely distributed. According to the most reliable report, those water-power plants alone which can be most easily and economically turned to electric power amount in the aggregate to about ten million horse-power; of this only three hundred thousand have already been utilised for the public, while one-half of it is in actual operation, and that mostly for lighting and power in cities and towns. Ordinary types of motors, generators and transformers are now made here of creditable quality, but iron and steel of special descriptions are imported every year to a great amount. Patent rights and manufacturing processes may be acquired from abroad, but without the help of trained foreign engineers, at least during the trial stage, it will be difficult to turn out articles of high-class quality.

Apparently there is a great boom in electrical industries in Japan, yet if we deduct the imported articles only a little will remain as the genuine product of home industry. One hears from contractors that all kinds of machines, both mechanical and electrical, are still imported through their hands, without any change, for places where reliable machines are in demand. These contractors are generally large firms, having long experience and trained hands. The so-called importers, whose business is conducted by foreigners with low-grade native employés, and without respectable Japanese associates, seem to have felt the effects of the change.

Of the present system of industry, as regards either sale or management on a scale fit for cheap production and a wide market, Japanese men of business have as yet had only short experience. Those industries which are now flourishing do not belong to the class of pioneer industries, and the channels of business have been prepared by the so-called importers. It will be clear that the co-operation of foreigners trained in international business is desirable, while for the manufacture of articles, complicated as regards process, delicate in fixing, or precise in measurement, the co-operation of trained foreign hands will be imperative. But on the side of management dealing with customers, understanding public taste, and the proper ways of speaking and writing, or in selecting the right person to communicate with—in short, in all that cannot be reached by reasoning and calculations alone—the co-operation of Japanese managers will be desirable. Further, the protective policy of the government and its general encouragement of home industries will be met by joint capitalisation. The days of monopolising interests are now gone for ever, and the day has come for mutual interest with joint responsibility, the rights of both parties being justly considered and clearly defined.

To me it seems that foreign firms and inventors are too neglectful of securing their patent rights in Japan. All the details of their inventions, so far as they are expounded in the technical papers in their own lands, are of course open to public scrutiny here and the so-called inventors here may resort to these papers and utilise them for their own benefit. In granting patent rights in this country, officials do not search through foreign patent records; it is advisable, therefore, that the real inventors or the lawful possessors of patent rights should pay more attention to this matter. The best thing to be done would be to secure their patent rights here, and to look at once for their exploitation, either in the form of co-operative working, or of selling the rights, or else on the basis of royalties. The market here is, of course, too small for large industries; and the most profitable inventions will be those dealing with the commonest kinds of articles, widely used in industry or by the public, or else such as will replace others which have already created a good market in this country.

In the exploitation of inventions and manufacturing processes there is one thing which might with benefit be resorted to. This is the publication in industrial or trade journals, in the Japanese language, of the general nature of the invention, of the manufacturing facilities, of the properties of the articles made, of places in which they may be most profitably employed, and so forth, accompanied with cuts or illustrations, and, when necessary, with the result of scientific testings, and with anything which will instruct people and induce them to make further inquiry. A few lines of advertisement in daily papers offering for sale the patent rights are of course useless, since their nature can only be understood by a few specialists, but not by the men who might take real interest in the transaction.

The following brief survey of the present state of electrical industries in Japan may be of some interest. The data have been collected within the last six months in the factories throughout the country and under my own personal observation.

Motors, generators, and transformers are made here in large quantities, to meet a very great demand which increases every year. As to the size, generators have been made up to 6,000-K.W. giving very good results under test. There are two large factories with long experience, one in some connection with the General Electric Company of the United States of America, the other as a part of a dockyard. Besides there is a large factory adjoining and in possession of a copper-mine, which promises to have a splendid future. Smaller factories which turn out smaller articles are many in number, and compete keenly with each other. All special iron and steel parts are imported, and these factories have always to keep them in stock, thereby causing unnecessary loss and inconvenience. Special types of machines, and those directly coupled with water and steam turbines, have been supplied by the importers and contractors; but even these are now being made in Japan to a small extent.

Carbon filament lamps are made here in a satisfactory way, though some difficulty is experienced in making them for 220 volts, and the filaments of superior qualities are all imported. Tungsten lamps of ordinary size are also made here in many places, both drawn and squirted wires being imported. Large factories in Kawasaki and Osaka are turning out tens of thousands of lamps every day, yet hardly enough to meet the public demand.

Porcelain insulators of good quality are made here to a large amount, leaving no room for importation, as suitable raw materials are plentiful in Kiushiu and other places. Among solid insulating materials other than porcelain, ebonite

*Abstract, from the *Journal* of the Society of Arts.

is the only sort which can be made in a good quality. No substitutes for ebonite nor any insulators to meet special circumstances are yet forthcoming, although such forms as lamp-sockets or ball-insulators for trolley lines are made to a great extent. Mica is largely found in Corea and Manchuria, though the quality is not high-grade. There is a prospect of finding the mineral of good quality in deeper places in the mines. It is still good enough for making some sort of micanite; but there was no factory for it till very recently. Superior kinds of mica are imported through London firms from India, and in most of the electric workshops they are used even where smaller pieces of inferior quality are good enough for the purpose. Very recently a patent right for bakelite has been acquired, and the manufacture will begin after one year. India-rubber insulating tapes are made in many places, usually on a small scale and in a very primitive way. Insulating compounds and varnishes are made only to a small extent; and none with special features are yet touched upon. Transformer oils are made at oil refineries, but it is not known whether they meet the strict requirements of electrical engineers. All other oils for making varnishes and compounds are imported, and they secure good prices.

Ammeters, voltmeters and kilowatt-hour meters are largely imported. Ammeters and voltmeters for A.C. and D.C. are also made here on a fair business scale and supplied for use with small motors, but they serve for indicating rather than for measuring, and the consumers of electric power in general are indifferent. I have seen such meters in process of calibration by an ordinary workman with no proper education for such work, who was giving an allowance of 20 per cent. either way, and calibrating with the fluctuating city supply as the electric source. There are some factories where they make switchboard instruments, accurate to within 3 or 4 per cent., supplied with the generators made by themselves, but these cost much more than imported ones made by well-known specialist firms in America and Europe. There is no manufacturer of instruments of precision fit for scientific use. For hot-wire instruments there is difficulty in obtaining proper wires. In some factories resistance-boxes are made, but with materials having high temperature co-efficients. The employment of physicists in factories began only a few years ago, and there are still places where men with no proper education hold the place of chief engineer. There is no place such as the National Physical Laboratory, or the Bureau of Standards. I have not seen at any commercial industrial workshop a really good potentiometer from well-known makers, and preserved in perfect condition, nor have I seen a battery of secondary cells for the electric source in calibration or testing of D.C. instruments, or in driving a motor-generator for A.C. instruments. Such special instruments as the oscillograph are still considered a luxurious equipment in places where they are much needed; but ohmmeters and such like are used to a great extent. Those meters, which serve in selling and buying electricity, must now pass the examination of the Teishinsho (Department of Communication). Among these meters, tariff meters are imported to a large amount, but competition being keen, and under the public idea that electric apparatus has no fixed price, they are sold at half the catalogue price, and in addition one quarter of the selling price is paid for the fee of examination. The number of these meters examined at the Teishinsho last year reached thirty-eight thousand, and the figure increases every year at a rapid rate.

None of the alloys used as the materials for electric resistances, except a small amount of German silver, are made here. Consequently all heating elements must be imported.

Rubber works are in a prosperous condition, but not sufficiently so to stop the importation entirely. The rubber works for the purpose of insulation have now become a part of wire and cable factories. Good rubber is, of course, imported from South America through London and New York firms, inferior quality rubber comes from the Straits Settlements, while the experimental cultivation of the tree in Formosa is likely to end in disappointment.

Copper wires of all descriptions, from power cables down to silk-covered wires and rubber cords, are made here almost to the entire exclusion of imported articles, and all these factories are apparently in a prosperous condition, though competition is very keen in this as in other industries. Enamelled wires are made in some of the factories, but the demand is still small and not yet established.

Dry cells are made in many places on a small scale, but the demand is increasing every year. Most of the factories do not possess the proper apparatus for testing their products, the general public accepting them untested, while in supplying governmental customers rigorous specifications are observed. Dry cells fit for storing, made of the type in which some liquid is poured in at the time they are used, are in demand by the Army, the Navy, and in the telegraph and telephone departments. Secondary cells of lead type are now made in two or three places, but the greater part of the demand, which is increasing every year, is supplied by importers. Those who are going to install them naturally pay attention to the life of the cells, and therefore look for the products of well-established foreign factories, native factories being still too young to insure good records for their products. Governmental customers use the native products, because they are instructed to do so and they have no personal interest in the question.

Electric carbons for dry cells and for arc lamps, and also those carbons which do not require special processes, are made in many places, though on a small scale. Thick carbon rods for searchlights and carbon granules for telephone work are not yet made here in proper quality; carbon brushes, though made, are much inferior to imported ones.

Public telephones and telegraphs are government monopolies, and the apparatus, being fixed in form, are old in type, except in a few instances where new inventions are employed by way of trials. Most of these public telephone and telegraph apparatus have been supplied by two firms, one purely Japanese and the other in close connection with the West, and the apparatus were subjected to severe trials according to the policy of the government.

Fittings for lighting used in Japanese houses are developing to meet the tastes of the people; but those for buildings of foreign style, for offices and dwelling-houses, which are increasing very rapidly, are imported articles. No electric irons are made here, nor any electric heaters or cooking utensils, while electric fans are only manufactured to a very limited extent. Suppliers of electricity are now competing fiercely with one another, but for current for lighting purposes only. When this contest comes to an end, and that will be very soon, the manufacture of all kinds of apparatus for domestic purposes will rise quickly to a state of prosperity.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Electrical Apparatus for Shearing Wool.

I have recently received an inquiry from a woolstapler for electrical apparatus for shearing wool from skins, and from what I can gather this is carried out by means of a wire kept at white heat by electricity. The idea, as above, hardly seems practicable, but perhaps some modified form may be in use at present. Would you be kind enough to insert this letter in your columns in order that I may get in touch with agents or manufacturers who specialise in electrical shearing apparatus?

My client informs me that he has been told by friends in the trade that apparatus working on the above lines is in successful use in Germany at the present time.

J. G. Bomford.

Stratford-on-Avon, *July 24th*, 1914.

Cab Tire Sheathed Cable.

We are interested to note your article on the proposed Testing Institution in the current week's issue, and agree with the author that a method which will prevent inferior material from being foisted upon the electrical industry will be of considerable value to that industry, especially in regard to its future.

Reference is made to the suitability of this Institution for testing electrical machinery and material which have not been long in practical operation, and the author of the article mentions cab tire sheathed cables for house wiring in this connection. He further states that, if suitable, this style of wiring will prove of the utmost benefit, but refers to other classes of cable which have not been successful, and queries how one is to know that cab tire sheathed cables will eventually prove to be any better than these.

We trust we may be allowed, as inventors and patentees of the cab tire sheathed type of cable, to give reasons for our opinion that this type will do what we claim for it.

In the first place, we have been makers of cab tires for the past 12 years, and at the present moment are about the largest manufacturers of these in the United Kingdom, turning out 5 or 6 tons per week of cab tires alone, for use all over the world.

It was in consequence of this intimate knowledge of the almost indestructible nature of cab tire compound that we decided to use it for sheathing electric cables; but before putting it on the market seriously, we carried out severe practical and laboratory tests upon it, with acids, oils, alkalis, ozone, &c., and we also examined cab tires in service that had been made by us as long ago as possible, to confirm our opinion as to absence of deterioration. Enclosed, for instance, is a piece of cab tire which was

supplied in May, 1906, to a coachbuilder's shop in the Newcastle district, where it was put on "show wheels" in the window, and which you will see is in perfect condition after this exposure of over eight years.

We also started testing the cable under working conditions at the earliest date possible, and can now show C.T.S. cables which have been in use in the most exposed positions for over three years, without the slightest indication of deterioration.

Under these circumstances, and in regard to the fact that we have largely advertised and sold this C.T.S. cable for use in the worst positions (where other cables have quickly failed) during the past three years, and that we have had practically no complaints during that period, we think that the confidence of our customers and ourselves in C.T.S. should now be shared in by the electrical profession generally.

May we add that while it is pleasant to note the gradual adoption of C.T.S. for wiring, by the more enterprising, it is interesting to observe how some electrical engineers shake their heads warily and continue to use the old-fashioned wiring systems which give trouble in so many cases, and which are frequently replaced by C.T.S.

St. Helens Cable and Rubber Co., Ltd.
J. H. C. Brooking, *Manager.*

Warrington,
August 1st, 1914.

Colonial Appointments.

Apropos of the letter in this week's Review on the subject of Colonial appointments, I should like to endorse your correspondent's warning, especially as regards the East, and that Cinderella of our profession, "Telegraph engineering."

Married men should never venture to the great cities of the East on salaries of less than £500 per annum. I could give you particulars of a married engineer, who, out of a salary of £450, had to pay £200 per annum for a suitable house.

M.I.E.E.

Arnside, Westmorland,
August 2nd, 1914.

Electrical Treatment of Milk.

Your article in this week's Electrical Review on the above subject of my patents is somewhat misleading and incorrect in various details.

I may say that after working on the problem for some months and taking out the customary patent protection, Mr. F. C. Lewis, then assistant in the Bacteriological Laboratory at the Liverpool University, was called in by me, and assisted me in the solving of the problem, but the patents therein are mine and will be strictly enforced.

A. Shelmerdine.

Liverpool, *August 1st*, 1914.

Electrical Engineers and the War.

Feeling sure that many experienced electrical engineers would willingly offer their services to the Government if required for duty in the event of war commencing against Britain, I should be pleased to hear from gentlemen willing to co-operate in forming a committee with the intention of creating an organisation for this purpose at the earliest possible moment.

W. Ellerd-Styles.

91, Forest Drive West, Leytonstone.

[A further reference to this matter will be found in our leading columns to-day.—Eds. Elec. Rev.]

Electric Light and Roman Catholicism.—A long and strict decree has just been issued by the Sacred Congregation of Rites, Rome, in which electric lights are absolutely forbidden on or over any altar containing the blessed sacrament or the relics of a saint.

NEW THREE-PHASE REPULSION MOTOR.

Three-phase, series-wound commutator motors with starting and speed regulation by brush displacement have found extensive practical application during recent years; they do not involve the complicated regulating devices, stepped or rotary transformers, stator tappings and the like, which are required by shunt motors. Nevertheless the transformer required between the stator and rotor of a series motor is an undesirable complication, particularly since it must be designed for the same power as the motor itself. A single-phase repulsion motor requires no transformer, and it is possible in some cases to replace with advantage a single three-phase motor by two single-phase Scott-connected repulsion motors. A. Heyland* has recently patented a design for a three-phase repulsion motor which is built, not as a simple rotating field machine, but with a chord winding (as in the Scherbius motor) and three pairs of short-circuited brushes, the angle between the brushes in each pair being rather less than the angle between the neighbouring stator phases. Such a motor is slightly smaller than a single-phase repulsion machine of equal power and much smaller than the equivalent pair of single-phase machines arranged for operation on three-phase current; it is larger than the pure rotating field series motor, but this is compensated by elimination of the transformer required by the latter. The new machine has identically the same characteristics as a series motor and combines therewith the well-known advantages of the single-phase repulsion motor.

Fig. 1 represents a two-pole machine, S being the stator winding with terminals 1, 2, 3, and R the rotor winding and commutator with three pairs of short-circuited brushes capable of simultaneous displacement. For simplicity, ring windings are assumed. The brushes are shown in their neutral position. The stator field is tri-axial, and linked between phases, as indicated by the triangularly arranged arrows in the rotor. In the free spaces between adjacent

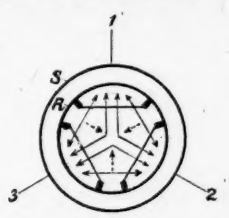


Fig. 1.

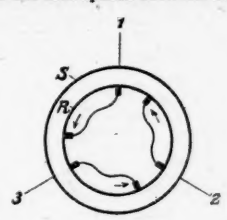


Fig. 2.

pairs of brushes, fields represented by the dotted arrows are produced by the currents induced in the short-circuit paths. The resultant effect is a single-axis field between the brushes of each pair (as represented by the pairs of parallel arrows), and this corresponds to the conditions in a single-phase repulsion motor. In the neutral position shown, the current between brushes is only sufficient to produce the dotted compensating field. At full speed the compensating field vanishes, and the machine is superior to a single-phase repulsion motor in that part only of the rotating field is produced by the rotor rotation, the remainder being produced directly by the three-phase stator winding; in consequence, phase displacement is less than in a single-phase repulsion motor, and can be corrected entirely by introducing a small compensating E.M.F. in the brush short-circuit. Exact compensation can be provided at all speeds, and the machine can be given shunt characteristics under working conditions. The important point is, however, that the machine operates as a pure repulsion motor at starting, and approaches more and more closely the characteristics of a rotating field motor as its speed increases.

As shown in fig. 2, the machine may be arranged on the Deri principle with one fixed and one movable brush in each pair. The same advantages are secured as in the Deri one-phase machine; the P.D. between brushes increases with their separation. If each moving brush be brought right up to the fixed brush in the next pair, the machine attains the characteristics of a rotating field motor.

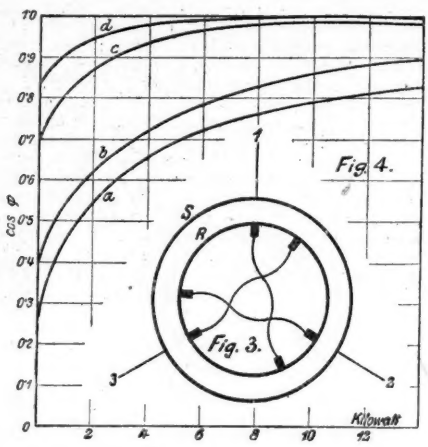
The new motor is but little larger than the ordinary three-phase machine of equal output. The chord winding produces less favourable loading of the slot bars, and the iron dimensions should be rather more liberal. The 10 per cent. additional outlay thus incurred is offset by elimination of the transformer. For a certain 50-H.P. hoisting installation, the cost of a three-phase series motor with transformer was £122 (£98 + £24); of two Scott-connected one-phase repulsion motors, £146; and of a Heyland three-phase repulsion motor, £108. Hitherto it has been considered necessary to carry current into the rotor to effect compensation, but in the Heyland motor the brushes are simply short-circuited. When the distance between the short-circuit brushes is extended beyond the angle of the stator phases, automatic internal phase compensation is set up by a resultant magnetising component due to overlapping of the stator phases by rotor current induced from the phases lying opposite. The automatic internal compensation effected is characteristic of this particular machine, and cannot be secured in a single-phase repulsion motor.

Fig. 3 shows diagrammatically a two-pole Heyland motor with crossed brush connections. In multipolar machines direct cross-overs are not necessary if the brush pairs be correctly spaced on

* See also *E.T.Z.*, pp. 85-86; 1914.

part only of the circumference (*e.g.*, every second one omitted); equalising connections between the commutator-bars are then required in wave windings. Generally the stationary brushes are mounted inside, and the movable brushes on the bearing side of the commutator. Fig. 4 shows the power factor under various loads of an 8·84-KW. motor :—(*a*) With simple squirrel-cage rotor ; (*b*) with brushes at 120° (the brushes of neighbouring sets coinciding in position) ; (*c*) with brushes at 160°, as in fig. 1 ; (*d*) with brushes at 160° and stationary brushes set forward 40° from the neutral position. Curve *b* shows a slight improvement in power factor due to suppression of harmonic fields ; curve *c* shows unity power factor at considerably lower loads. Compensation being by a current component which is proportional to the main current, the power factor curves fig. 4 are quite smooth. In reversible motors, the commutator frictional drag advances the stationary brushes automatically.

Phase compensation is best near synchronous speed. Corresponding to various brush settings, the machine runs at certain speeds which do not rise much above synchronism as the load is



FIGS. 3 AND 4.

reduced. The compensating action resembles the behaviour of a synchronous motor except in respect of the internal self-excitation and variable speed characteristics. The new machine possesses the simplicity of a single-phase repulsion motor without its disadvantages in the shape of auxiliary compensation, &c. In size and efficiency the Heyland three-phase repulsion motor is practically identical with the corresponding series motor, the stator winding and number of poles being altered to allow for the fact that the series motor runs 50 per cent. over synchronism whereas the repulsion machine runs more or less synchronously. Below synchronism the new machine has series characteristics, but near synchronism it assumes shunt characteristics, and is, therefore, an ideal hoisting motor. The automatic internal compensation permits the machine to be designed with relatively weak field even for heavy overload and hence keeps the KVA. demand low when starting under heavy load. The motor is the simplest yet available for power factor improvement.

THE DEVELOPMENT OF THE MERCURY RECTIFIER FOR LARGE OUTPUTS.*

THE idea of employing an iron enclosing case in place of a glass one for the mercury rectifier is an old one and was, in fact, suggested by Cooper-Hewitt, the discoverer of the rectifier, in a Swiss patent of 1903. The clearing up of the many minor difficulties in connection with the small power glass rectifiers, however, seems to have kept this suggestion in the background for some years. The first forward step in this direction was made by the General Electric Co., of America, and their experimental work was embodied in various patents in 1909 and 1910. The Allgemeine Elektrizitäts Gesellschaft also took out a patent on the same lines in 1910. From that time onwards work has been going on steadily in this direction. In 1912 the first model of the G.E.C. iron-cased rectifier was tested in Germany. It consisted of two tall iron cylinders, each containing a subdivided mercury cathode and two anodes, and each cylinder was surrounded by a cooling chamber with water circulation. Two such cylinders in parallel were used to convert 80 KW. of single-phase alternating-current power into direct current. The sealing of the chambers was accomplished by alternate concentric rings of rubber and lead or asbestos and lead and was satisfactory, although the exhausting pump had to be kept continuously at work whilst the rectifier was in operation. For three-phase work three cylinders were used.

A little later the A.E.G. introduced a construction in which a single cylinder contained all the anodes and the cathode required for three-phase work. With this single cylinder construction, however, when as much as 100 KW. had to be dealt with, considerable difficulty was experienced in removing the heat from the internal parts and in sufficiently insulating the various anodes from one another.

Finally, the shape which had already worked successfully in the case of the glass rectifiers has been adopted both by the G.E.C. and the A.E.G. The anodes, in fact, are placed in separate side chambers projecting more or less radially at intervals out of a central cylinder containing the common cathode. In this way the anodes are removed from the path of the so-called "cathode flame," consisting of electrically neutral particles of mercury

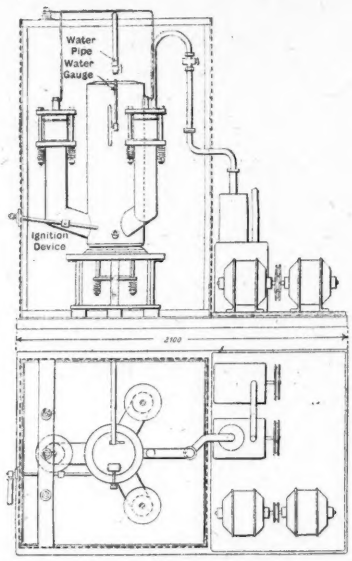


FIG. 1.—100-KW. MERCURY RECTIFIER.

which have been driven upwards by the heat. In previous constructions trouble often resulted from some of these particles reaching the anode surface, and when this occurs, even if only momentarily, there is the risk of one of the anodes being converted into a temporary mercury cathode, and so stopping the valve action of the apparatus and leading to a short circuit between anodes.

In fig. 1 is given a dimensioned drawing of an A.E.G. rectifier of this latest type (1913) for an output of 100 KW. from three-phase to direct current, the direct current output being 350 volts 300 amperes. It consists of a cylindrical iron vessel about 1 m. high and ·415 m. diameter. The cylinder is entirely closed at the

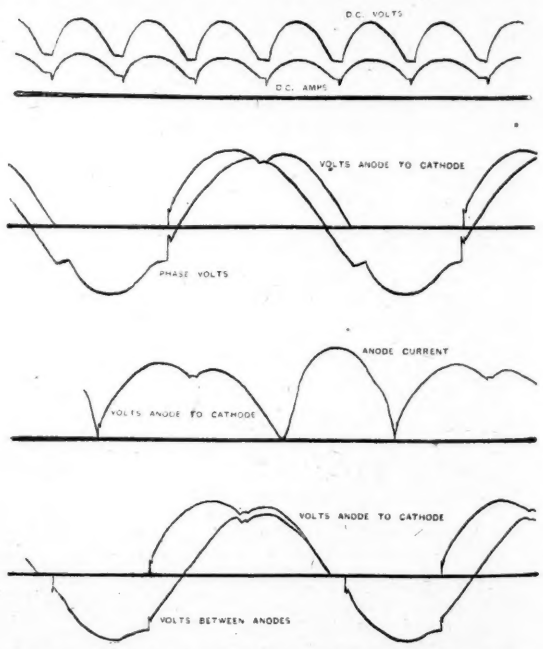


FIG. 2.—OSCILLOGRAPH RECORDS OF RECTIFIER WORKING.

bottom, whilst the top cover is formed by an open tank ·8 m. deep and ·3 m. in diameter, the bottom of which closes the condensing chamber of the rectifier, whilst the tank itself is filled with about 55 litres of water, which, by its slow evaporation, gives all the necessary cooling effect, and only requires refilling about once in 24 hours of continuous work.

* Dr. K. Norden, in the *E.T.Z.*,

At the lower part of the cylinder three iron pipes are welded on radially, with an upward bend. At the top of these pipes the three iron anodes are fixed in insulating and air-tight supports, consisting of porcelain, asbestos and mica, sealed with lead rings against the atmospheric pressure. The mercury cathode lies at the bottom of the central cylinder. The starting or ignition anode is fixed to a slanting rotatable axis, which can be operated either by hand or automatically. The arc can be examined through a small window covered with mica.

The following results of a test carried out by Prof. E Orlich on one of these rectifiers show the capabilities of the apparatus. The rectifier was supplied from a three-phase transformer at 50 ~. Three dynamometer wattmeters were connected on the A.C. side to measure the input power. These three meters showed practically equal powers, indicating effective symmetry of the load. The rectifier was loaded by connecting a 110-volt D.C. supply circuit through a practically non-inductive resistance between the cathode and the neutral point of the three-phase transformer. No choking coil was introduced to smooth out the direct-current fluctuations. As measurements of only the true direct-current component of the output were required, moving coil d'Arsonval instruments were used on the D.C. side, so that, if anything, the efficiency obtained is a little on the low side. The readings were quite steady, and all the apparatus was checked after the test by potentiometer. As will be seen, the rectifier was run continuously for four hours at 100 KW., and throughout this test, with the exception of the first reading, when the rectifier had not yet warmed up, the efficiency remained constant at about 90 per cent. The starting electrode was disconnected soon after the start of the test, and was not required again. The pump was kept running during the first three hours, and was then cut off, and the vacuum remained good not only for the remaining hour, but during various other tests carried out during the evening. It was, however, found impossible to work continuously without running the pumps. The efficiency was still very good at such low loads as 10 KW., or even 2·3 KW. When the direct-current output was still further reduced, the rectifier still operated satisfactorily down to a minimum of about 3 amperes, when it went out, and could not be re-started at this low value. Even when cold, the operation was satisfactory from 7 amperes upwards without the continuous use of the starting electrode.

Time.	Three phase			Direct current			Efficiency.
	Line volts.	Amps. per phase.	Total KW.	Volts.	Amps.	KW.	
2.41	557	100	69·7	332	182	60·4	86·7%
2.50	550	170	110·5	338	295	99·5	90·1%
3.13	559	170	110·1	337	292	98·4	90·2%
3.48	558	170	108·8	338	291	98·2	90·3%*
4.37	554	170	108·9	338	290	98·1	90·1%
5.58	565	170	111·4	342	294	100·6	90·4%†
7.3	579	80	54·1	358	137	49	90·6%
	579	—	2·69	358	6·5	2·31	86 %
	578	—	11·1	358	27·7	9·9	89 %

* Starting arc cut out at 3.45.
† Pumps cut off at 6.20, and test continued at 100 KW. till 7 p.m.

The oscillograph records in fig. 2 indicate that the change of the rectifier arc from one anode to another takes place reliably and regularly; they are in all respects comparable with the results from the older rectifiers. The temperature reached, although higher than allowed in ordinary electrical machinery, is moderate and permissible considering the materials employed in this case.

Besides this 350-volt 300-ampere size, the A.E.G. has now in preparation similar rectifiers with longer anode tubes for higher voltages, and others with wider anode tubes for heavier currents. The General Electric Co., of America, has, on the same lines, produced sizes which give outputs of as much as 1,000 KW., viz., 600 or 700 amps. at 1,200 volts continuously (and even 2,400 volts), whilst intermittently as much as 2,700 volts is obtainable.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Electrical Colliery Plant.

The first consideration in the arrangement of a scheme for sinking a shaft is the electrical installation, for, in modern colliery practice, electrical power is used right from the commencement, enabling considerable economies to be effected.

At the Coventry Colliery of the Warwickshire Coal Co., where sinking operations are at present proceeding, one of the first steps was the installation of a large electric power house with sufficient plant to afford an adequate supply of electric power for sinking, while ample space has been left for future extensions. Steam winding engines have been installed, and their exhaust is utilised in mixed-pressure turbine-generators.

In the exhaust mains a Rateau-Morrison steam accumulator is inserted to afford a uniform supply of steam to the exhaust turbines with sufficient capacity to bridge over a stoppage of half-a-minute. In addition, there is a connection direct from the boilers to the mixed-pressure turbines by means of which the turbines can draw live steam at times when the winding engines are not at work or do not afford an adequate supply of exhaust steam. The condensing water is cooled by the spray method, in a cooling pond constructed of concrete throughout, 152 ft. long, 113 ft. wide, and 4 ft. deep. There are 224 nozzles. The pond has a capacity of 315,000 gallons per hour, effecting a reduction in temperature from 95° F. to 80° F. The pond also acts as a reservoir.

It is anticipated that with coal winning in full swing the engines will afford an average supply of 50,000 lb. of steam per hour at a pressure of 2 lb. per sq. in. to the turbines, or sufficient to generate 1,250 KW. continuously.

The present generating plant consists of two 880-K.V.A. "Witton" turbo-alternators driven by the mixed-pressure turbines at a speed of 3,000 R.P.M. Three-phase power is generated at a

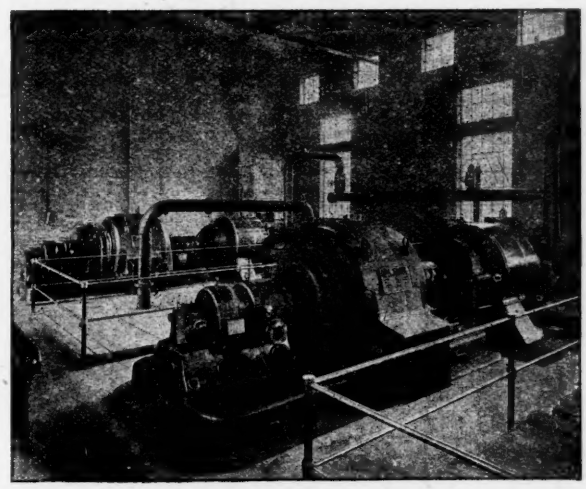


FIG. 1.—COLLIERY POWER HOUSE, SHOWING TWO 880-K.V.A. "WITTON" TURBO-GENERATORS.

pressure of 2,750 volts, 50 cycles. The exciters for the turbines are direct coupled, as shown in the view of the engine room, fig. 1. A third and similar set will probably be installed. The air pumps and other auxiliaries are steam driven, with the exception of two centrifugal pumps giving a supply of 240 gallons of water per minute against a total head of 39 ft., and driven by 7·5-H.P. "Witton" motors. These are used for supplying water to cool the oil which lubricates the bearings of the turbines, and for emptying the cooling pond.

For lighting purposes there has been installed a 55-KW. "Witton" generator driven by a high-speed steam engine, which gives a three-wire D.C. supply at 230 volts across the outers, a static balancer giving the necessary neutral connection. This set is only used when the winding engines are not at work. When exhaust steam is available lighting current is taken from the main alternating-current supply, the conversion from alternating to direct-current being effected by a 55-KW. "Witton" motor-generator running at 580 R.P.M.

The generators have been designed with high internal leakage reactance in order to enable them to withstand heavy short-circuits without damage to the windings. Close regulation is obtained by means of a Brown, Boveri voltage regulator. The colliery works with an insulated neutral.

The electrical generating plant was supplied by the GENERAL ELECTRIC CO., LTD., of 67, Queen Victoria Street, E.C., and Mr. W. C. Mountain, of Newcastle-on-Tyne, is the consulting engineer for the scheme. We are indebted to Mr. A. M. Russell and Mr. J. W. Liddell, the agent and manager of the colliery, for permission to publish this description, and to Mr. W. C. Mountain for particulars of the plant.

Electrolytic Rectifier.

MESSRS. ISENTHAL & CO., of Denzil Works, Neasden, N.W., have introduced an improved grid type electrolytic rectifier, in which the heavy glass containers have been replaced by a single steel tank container only, although both half waves of the A.C. are utilised.

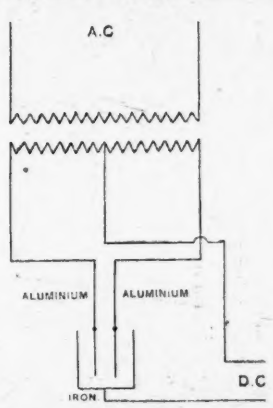


FIG. 2.—RECTIFIER CONNECTIONS.

The critical voltage of the cells has been raised, and higher D.C. voltages than formerly can be secured. The leakage current has been reduced, and no special cooling arrangements are necessary.

Rectifier, switchboard and transformers now form a self-contained set, and various control panels can be provided according to the purpose for which the apparatus is used.

Fig. 3 illustrates the positive elements of a 5-ampere type rectifier.

These are rigidly assembled, but can be easily replaced; the portion of the element which passes through the level of the

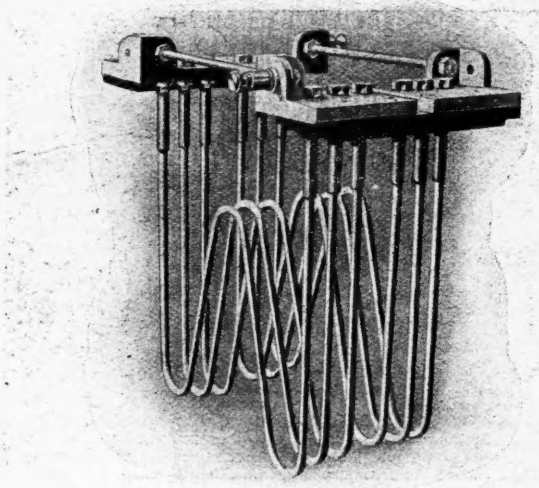


Fig. 3.—Positive Elements, Improved Rectifier.

electrolyte is carefully protected from corrosive effects. The positive elements when sent out are practically ready for work, having undergone formation.

The standard types are for use on single-phase A.C. or on one phase of a multiphase supply; the design can, however, be modified to utilise all phases equally, if necessary. The apparatus is suitable for charging ignition and other accumulators, for running D.C. motors, working mercury vapour, and projection lamps, &c.

Self-Acting Starter for Polyphase Pump Motors.

Particulars of a new controlling apparatus, illustrated in fig. 4, have been sent to us by the Igranic Electric Co., of 147, Queen Victoria Street, London. We understand that many of these self-

Fig. 4.—Self-acting Starter.

acting starters have already been installed and are working in various parts of the country driving centrifugal pumps and apparatus with similar load characteristics.

The self-starter is of the multiple clapper type, consisting of a plain slate switchboard which carries the clapper switches and the relays controlling the motor and auto-transformer circuits, and it can be controlled either by push buttons, float switch, tappet switch or pressure regulator. This type of self-starter we are informed is standardised from 15 to 175 B.H.P.

Temporary Wiring.

Fig. 5 shows the wall plugs introduced by Messrs. Reyrolle and Co., of Hebburn, used for stage purposes. The object has been to provide a good mechanical job of the wiring up to the

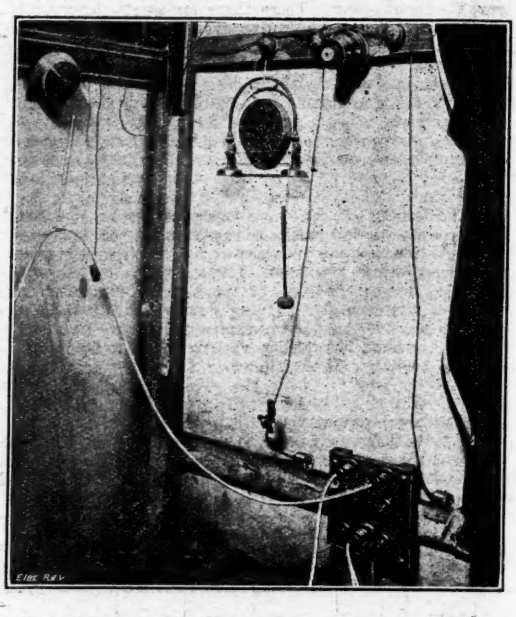
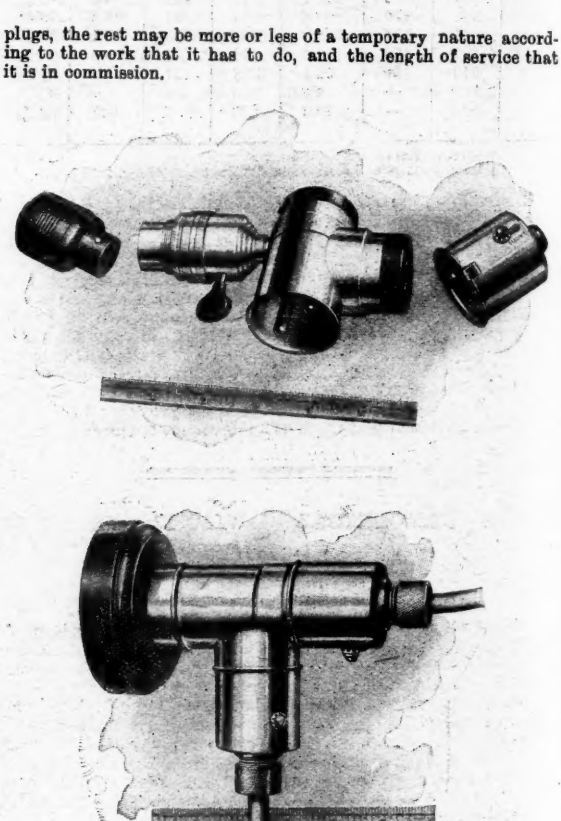


Fig. 5.—Reyrolle Wall Plugs on the Stage.

plugs, the rest may be more or less of a temporary nature according to the work that it has to do, and the length of service that it is in commission.



Figs. 6 and 7.—Reyrolle Adapters.

The plugs are made so that the pins are shrouded by the cover and it is impossible to make accidental contact with the pins when

alive; in cases such as that illustrated, when plugs have to be manipulated in a hurry, this feature is very necessary. Also the mechanical protection afforded by the shroud avoids risk of injuring the pins in rough service.

Figs. 6 and 7 illustrate adapters provided for use with the plug board in order to obtain more than one connection from a socket, or to insert dimmers or any other apparatus for various stage effects.

LEGAL.

Powers of Jamaica Electric Co., Ltd.

On July 29th judgment was given at the Privy Council in two appeals, in the first of which the West India Electric Co., Ltd., was the respondent, and in the second appellant. The appeals were tried together as they both involved the construction of the Electric Co.'s licence to work tramways in the neighbourhood of Kingston, Jamaica.

Lord Sumner, who delivered the judgment of the Court, said the action was brought to recover 6d. paid under protest. Shortly, the appellant's grievance was that he ought to be carried for a maximum fare of 2d. between any two points in any one of the three districts defined by the respondents' licence, whether or not such journey involved a change of cars. The Supreme Court of Jamaica held that the charges made by the Electric Co. were within the powers conferred on them by the licence, and dismissed his action.

His Lordship said that they were of opinion that the decision appealed from must be affirmed, with costs.

In the second appeal, in which the company were appellants and the Attorney-General of Jamaica respondent, the company were again successful.

Lord Sumner said that this action was brought by the company against the Attorney-General as representing the executive of the Colony, in order to settle various questions long at issue between the company and the Government. The Board was of opinion that the appeal of the Electric Co. should be allowed, with costs, and the judgment of the Supreme Court and that of the Chief Justice of Jamaica, which it affirmed, set aside.

Oriental Telephone and Electric Co., Ltd.

The case of Baillie *v.* The Oriental Telephone and Electric Co., Ltd., came before Mr. Justice Astbury, on a motion by the plaintiff, to restrain the company and its directors from acting on resolutions on the ground alleged, that they were invalid, because of insufficient notice.

Mr. Russell, K.C., for plaintiff, said that the evidence on both sides was in conflict, and it having been stated that the directors did not intend to act on the resolutions, he suggested that the motion should stand over till the second motion day next sittings.

Sir C. Macassey, for the defendants, agreed.

His Lordship directed the motion to stand over accordingly, and gave leave to each party, on 10 days' notice before it came on, to give notice to cross-examine witneses.

A Lift Case.

At the West Riding Assizes last week, Henry Redfearn, a labourer, was awarded £250 damages against Messrs. Smith, Major and Stevens, Ltd., Birmingham. Plaintiff was injured by a falling balance weight while assisting in the erection of lift gates which Messrs. Smith, Major & Stevens were installing at Messrs. Reckitts' works. Redfearn only claimed £41, £24 of which represented wages.

A Kite and a Colliery.

Two young kite flyers were recently summoned at Tredegar for wilfully damaging electric power lines at the Markham Colliery. The lads were flying a kite with a wire attached, and the latter apparently came into contact with and short-circuited the transmission line to the Markham Colliery, which was immediately shut down. Two hundred men were in the mine, and the ventilating plant was stopped.

A Tramway Ticket.

At Bolton, last week, John Richardson was summoned under a local by-law for failing to produce his ticket when requested to do so by an inspector. It was stated that the defendant boarded a tramcar on July 9th and received a ticket, for which he paid a penny.

The defence was that the defendant never received a ticket, owing, he suggested, to the fact that the conductor had not at the moment change for a shilling. There was no dispute, said defendant, about the fact that he had paid the penny.

The case was dismissed, the Mayor stating that the Bench believed the defendant had paid his fare.

Carrickmacross Lighting.—The Urban Council has arranged a three years' contract for the electric lighting of the town.

OUR LEGAL QUERY COLUMN.

"Pacific" writes:—"According to the Electric Lighting Acts the undertakers have the right of admission 'at all reasonable times to any premises to which electricity is supplied by the undertakers' in order to inspect the electrical apparatus or disconnect supply, &c. (Sec. 24, Electric Lighting Act, 1882.)

"In some cases the tenants wilfully refuse admission, or will not answer the door.

"What is the correct procedure on the part of the undertakers who have been kept out for, say, six months, while the refusal to admit for the inspection of meters or disconnection continues? Can the undertakers make a forced entry after serving a proper notice on the tenant, and then finding that the obstruction on the part of the tenant still continues; or should the undertakers apply for a magistrate's warrant?"

*** Sec. 24 of the Act of 1882 provides that any officer appointed by the undertakers may at all reasonable times enter any premises to which electricity is, or has been, supplied by the undertakers, in order to inspect the electric lines, meters, accumulators, fittings, works and apparatus for the supply of electricity belonging to the undertakers, and for the purpose of ascertaining the quantity of electricity consumed or supplied, or where a supply of electricity is no longer required, or when the undertakers are authorised to take away and cut off the supply of electricity from any premises, for the purpose of removing any electric lines, accumulators, fittings, works or apparatus belonging to the undertakers, repairing all damage caused by such entry, inspection or removal. This section corresponds to Sec. 21 of the Gasworks Clauses Act, 1871, but strange to say the latter provides for a penalty for hindering the officer. There is apparently one law for gas and another for electricity in this respect. The question is:—How can the undertakers enforce their rights? It would seem that the provisional order really amounts to a contract between the consumer and those who supply electric light, and the remedy would be to bring an action to compel the consumer to allow an inspector to enter. No lawyer would advise forcible entry; but if such entry were effected and an action, or prosecution, were commenced for the trespass, the defence of leave and licence by statutory authority would probably hold good.

"Wulfruna" writes:—"Are electric supply undertakings liable for damages caused by fire: (*a*) Due to faults of service cables on consumers' premises; (*b*) due to faults in wiring installations which are the property of the undertaking, assuming there is no evidence of negligence on the part of the undertakers?"

*** Sec. 77 of the schedule to the Electric Lighting (Clauses) Act, 1899, provides that: "The undertakers shall be answerable for all accidents, damages, and injuries happening through the Act or default of the undertakers, or of any person in their employment, by reason of, or in consequence of, any of the undertaker's works, and shall save harmless all authorities, bodies, and persons by whom any street is repairable, and all other authorities, companies, and bodies collectively and individually, and their officers and servants, from all damages and costs in respect of those accidents, damages and injuries." By Clause 81 "Nothing in the Special Order shall exonerate the undertakers from any indictment, action, or other proceedings for nuisance in the event of any nuisance being caused or permitted by them." It has been decided that in the case of mains in the street being defective and fire resulting, the undertakers are liable. In Midwood *v.* Manchester Corporation (1905) 2 K.B. 597, the facts were that a main fused and the bitumen in which the main was laid, in consequence, became volatilised into an inflammable gas, which accumulated for some time, and then exploded, causing a fire, by which the plaintiffs' goods were damaged. It was held by the Court of Appeal that apart from negligence the Corporation were liable to the plaintiffs as for a nuisance by reason of a section similar to Sec. 77 *supra*. It is apprehended that if the service cables on a consumer's premises were defective, and the lines had been laid by, and were under the control of, the undertakers, they would be responsible for any consequences that might ensue.

Mail, Telegraph and Telephone in Europe and the States.—Comparison between the use made of letter post, telegraph and telephone services in Europe and the United States shows predominance of the letter post in Europe and of the telephone in the States (chiefly due to the great use made of local telephone service in America). As shown by the following statistics, referring to 1911 and the latest available, relatively few messages are transmitted by telegraph either in Europe or the States. (Population of Europe approximately 400 millions, of U.S.A. approximately 100 millions).

	Messages by—		
Europe—	Letter.	Telegram.	Telephone.
Total (millions)	16,500	370	6,000
Per cent. of total	72·2	1·6	26·2
Per 1,000 inhabitants ...	37·3	0·8	13·6
United States—			
Total (millions)—	9,700	108	14,400
Per cent. of total	40·07	0·45	59·48
Per 1,000 inhabitants ...	102·5	1·1	152·1

Dt. Verkehrsztg.

PARLIAMENTARY.

Manchester Corporation Bill.

The Bill of the Manchester Corporation, which had already been before a House of Lords Committee, came up for consideration before a Select Committee of the House of Commons. Under the Bill the Corporation were seeking various powers, some of which, as reported in the Electrical Review at the time, were rejected by the House of Lords' Committee. The Bill as now modified, amongst other things, authorises the Corporation to erect a generating station at Davyhulme, at a cost of £1,200,000. Additional powers were also sought for the provision of motor-omnibuses, and an extension of the time for the construction of certain pieces of tramway already authorised was asked for.

Mr. McElroy, the manager of the Corporation tramways, was examined at considerable length in regard to that part of the Bill referring to motor-'buses. He said that they desired to carry parcels on the 'buses exactly in the same way as they did now on the tramways. He thought it would be very unfair to put a charge upon the Corporation for running over the bridges of the Great Central Railway—railway companies had the full use of the roads belonging to the Corporation without any special charge.

On the 28th ult., after hearing further evidence, the Committee passed the preamble of the Bill. On the question of road contributions, the Committee decided that inside the city no contribution should be paid other than that provided by a clause under which the Corporation already undertake to contribute to the cost of the repair of the bridges, if, by their excessive use of them, such work is rendered necessary. With regard to roads outside the city, if the road authorities are paid any sum for the right to run motor-'buses, the railway companies are to be treated in the same way as regards their roads and bridges.

Bristol Tramways Bill.

After three days' hearing of the Tramways Bill promoted by the Bristol Corporation before a Select Committee of the House of Commons, presided over by Sir Edwin Cornwall, the parties came to an agreement, and the Bill was reported for third reading. There was a large array of counsel, as besides those representing the Corporation and the Tramways Co., a number of property owners and ratepayers were represented.

The Hon. J. D. Fitzgerald, K.C., who led for the Corporation, explained that the object of the Bill was to enable the Corporation to purchase the tramway undertaking of the Tramways Co. and work the same. The Bill had passed a Committee of the House of Lords, and was now being opposed by certain ratepayers and property owners. He contended that the poll of the citizens, which was taken, showed that the proposals of the Corporation had the support of the bulk of the ratepapers.

Mr. Freeman, K.C., argued the case generally for the opponents, and contended that the Corporation were plunging into an undertaking which they could not get out of, on entirely insufficient data. Obviously, the whole foundation of the question whether the bargain was good or bad depended on the price to be paid. They knew that the price was £300,000 for the part of the undertaking inside the city, and £70,000 for the part outside, but a point which had not been taken into consideration was what the Corporation might have to pay for lines not yet constructed if the company exercised its rights and constructed such lines.

In the end the parties came to an agreement to insert a clause providing that, if the Corporation exercised their option of purchase in May next, they must acquire the whole undertaking of the company.

Royal Assent.—The following Acts have received the Royal Assent:—

Electric Lighting Orders Confirmation Acts, Nos. 2, 4, 6, 7 and 9.
North Metropolitan Electric Power Supply Act.
Norwich Electric Tramways Act.
Hightown Gas and Electricity Act.
Deal and Walmer Gas and Electricity Act.
Shropshire, Worcestershire and Staffordshire Electric Power Act.
London United Tramways Act.
Yorkshire Electric Power Act.
London, Brighton and South Coast Railway Act.

Motor-'buses and Road Tax.—The House of Lords Committee which has been considering the Sheffield Corporation Bill in regard to running motor-'bus services over four local routes, generally upheld the decision of the Commons Committee in regard to road maintenance contributions, but held that any Government road grant should be used to diminish *pro rata* the expense borne by the County Councils and the Corporation, and that in no case should the benefit of the grant accrue solely to the Corporation.

Electric Vehicle Committee.—The Electric Vehicle Association of America, which is holding its annual convention in Philadelphia on October 19th, 20th and 21st, has issued a welcome to any British engineers interested in the electric vehicle, who propose being in the United States at the time. The Electric Vehicle Committee is being represented by its chairman, Mr. R. A. Chattock, of Birmingham.

BUSINESS NOTES.

Consular Notes.—RUSSIAN FAR EAST.—The American Consul at Vladivostok reports that the Vladivostok Trading Port having been unsuccessful in coming to an agreement with the municipality on the question of furnishing electric power, it has been decided by the Department of Commerce and Industry that an independent station shall be built to supply the necessary power for the Trading Port.

CHINA.—According to the American Consul at Hankow, a large German firm has been attempting to secure a franchise from the several foreign concessions in Hankow for a short railway. The matter came before the ratepayers of the British concession at Hankow on March 12th, when it was decided to refer it to a committee appointed by the Municipal Council, no final scheme to be adopted without sanction of the ratepayers at a special meeting. It was also stipulated that the line should not be allowed to pass along the Bund. The Consul observes that this is an example of the kind of opportunities which would present themselves to American firms if they were established in the district. Without more or less permanent representation business of this kind cannot be handled.

TURKEY.—A monthly report of the French Chamber of Commerce at Constantinople points out that, although electric table lamps have not as yet been imported into Turkey in any quantity, a rapidly increasing demand for these goods may confidently be anticipated in the future. At the present moment the majority of the imports come from Germany, and the remainder from France.

ITALY.—A recent issue of the "Handelsmuseum," the official organ of the Austrian Commercial Intelligence Office, states that the use of water power for agricultural and industrial purposes in Italy is rapidly increasing, for the more intensive cultivation of the soil in the case of agriculture, and, in the case of industries, to relieve the manufacturers of the expense entailed by importing foreign coal. The Government recently presented to Parliament a Bill to provide for the construction of dams and artificial lakes in Calabria and Sardinia; in the former case chiefly for the development and distribution of motive power, and in the latter chiefly for irrigation purposes. It is estimated that in Calabria 170,000 H.P. will be made available, whilst in Sardinia 20,000 hectares of land can be watered, and power developed to the extent of 11,000 H.P., which in part can be utilised for pumping the water into the irrigation channels.

MEXICO.—The British Consul at Colima reports that the new Hydro-Electric Co. (German-Mexican) has completed the transmission line from its proposed power station to the distributing station in the city of Colima. The first power station, situated about 20 miles from Colima, on the Tuxpan River, is expected to generate some 6,000 H.P. According to its concession, the company can erect two other power stations higher up the river, as may be needed. On neither the first dam nor the power station has work been commenced. It is proposed to finance the undertaking in London, and the Consul advises intending investors carefully to study the situation.

SWEDEN.—The American Consul at Gothenburg, in a recent report, states that though electric supplies are extensively manufactured in Sweden, imports from foreign countries are considerable, especially from Germany. Lamps, sockets, insulators, wiring material and fixtures are all imported. Sockets are always of the American Edison screw standard. The demand may be said to be for rather cheap articles, which the dealers seem to handle almost to the entire exclusion of the more expensive grades. This is doubtless due to the fact that individual dwellings are few, and, comparatively speaking, the number of householders small. The population is housed almost entirely in apartments, and in the construction of them every expense possible is spared. There are usually from six to ten apartments in each house. The buildings are almost always of brick, though stone basements are frequently seen. In most of the buildings now being erected the wires are concealed within the walls and ceilings. For protection, metal-covered conduits (Bergmann's) are in general use. Both lead and steel are used. In the older buildings the wiring is run along the surface. It is customary for the owners of the apartment houses to put in the wiring, but the light fixtures are owned by the persons leasing the property. On April 1st, 1913, it was estimated that there were 12,845 consumers of electricity in Gothenburg, mostly for lighting, and it is estimated that 190,000 lamps of various sizes are in use. Electricity is also used to a certain extent for cooking and heating, and, of course, for general industrial purposes. Similar conditions prevail in Malmo, a city of 90,000 inhabitants, and second in importance to Gothenburg in the district. It is possible, however, that the consumption of electricity is relatively somewhat less in Malmo. There are, in addition, a number of smaller towns in which electricity for lighting and industrial purposes is in general use, among them Helsingborg and Jonkoping. Prices quoted to Gothenburg dealers are subject to a discount of 20 to 30 per cent. German manufacturers usually extend to the Swedish importers three months' credit, or even longer at times, if desired. For cash within 30 days a discount of 2 per cent. is allowed. Similar terms are given by Swedish manufacturers. There are no large dealers in electrical supplies in the district. The business is in the hands of contractors, who do installation work, and carry more or less limited stocks to meet their own needs and the general trade.

These contractors import direct from foreign manufacturers or buy from the Swedish concerns. The municipal laws of Gothenburg require that a contractor must have a special licence before he may undertake to install electric wiring, the object being to ensure care and safety in installation.

In attempting to develop a market in Sweden, it should be borne in mind that the importers and dealers here are familiar with the metric system only. They are not disposed to concern themselves with catalogues that quote measurements in inches and feet, and weights in ounces and pounds. This is a matter of the utmost importance. If prices could be given in the currency of Sweden, that also would be an advantage, but it is not nearly so important as the question of measurement.

Importers in Sweden generally understand English, but in the electrical-supply business it is probable that German is read by more persons than English. If a catalogue is prepared for the German-speaking peoples, such a catalogue will prove very useful in Sweden, especially if the metric system is used and prices are quoted in German currency. It should be made very clear, however, that the catalogue is not that of a German house. This suggestion is made in view of the fact that it would hardly be advisable to prepare catalogues for Sweden alone.

The electric light plants in Gothenburg and Malmo and most of the other cities are the property of the municipalities. Supplies for them are obtained when possible from Swedish manufacturers, otherwise they are imported direct.

In 1910 there were two Swedish manufactories of electric lamps, and their combined output was valued at £62,000. The same year four factories were engaged in making insulating material, and the output was valued at £130,000. On the other hand, incandescent lamps to the value of £59,000 were imported in 1911, besides wiring material, insulated and uninsulated, £360,000; and Bergmann's conduits, £9,000. These latter appear to have been almost all of iron, with a few of brass or paper. Decidedly the most important item in the import of wiring was electric cables, sheathed with lead or armoured with iron, valued at over £200,000.

Germany supplied nine-tenths of the lamps, with a few from the Netherlands and other countries, and a similar proportion of the import of wiring materials of all sorts, conduits, and electric meters, with negligible imports from Great Britain and the Netherlands.

The export of electrical material from Sweden in 1911 was: Lamps, £11,000; wires and cables, £43,000. Russia was the largest purchaser.

Trade Announcements.—The Edison & Swan United Electric Light Co, Ltd., notify us that, owing to important Government business, they have been compelled to abandon the holidays fixed for the present week, and they re-opened on Monday last, August 3rd.

The business of the Rhondda Electrical Installation Co., of 25 and 125, High Street, Treorchy, has been taken over by Mr. David Lewis Short.

Messrs. Andrew Brown & Co., 118, Cannon Street, E.C. have been appointed sole agents for the United Kingdom for La Société Anonyme L'Industrie, of Louvain (Belgium), manufacturers of rolling stock for railways, tramways and mines, contractors' wagons, ore wagons, &c.

Catalogues and Lists.—Edward Duisberg, 28, Victoria Street, S.W.—Thirty-six-page catalogue, E14, giving full particulars, prices, &c., of Gunther twist drills, counterSinks, reamers, sleeves, extension sockets, &c. The first few pages contain instructive data regarding drilling, grinding and lubrication.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, E.C.—Leaflet describing an interesting application of overhead aluminium feeders, effecting a saving of 36 per cent. in cost of conductors.

British Thomson-Houston Co., Mazda House, 77, Upper Thames Street, E.C.—Price list, No. 10,160, of B.T.H. Edison carbon lamps, containing in addition to the usual data as to prices and candle-power, and information as to comparative tests on these and other lamps.

Union Electric Co., Ltd., Park Street, Southwark, S.E.—First number of the "Union Quarterly," a house journal, containing 16 pages of illustrated matter. No. 1 contains an article on belt driving, descriptions of the "Diamax" Excello arc lamp, and the Union Co.'s dynamo and motor works, and other matters of interest.

Igranic Electric Co., Ltd., 147, Queen Victoria Street, E.C.—Pamphlet No. 613, entitled "The Compulsion of Utility," describing the Igranic push-button control system.

Germany.—The cartel of German manufacturers of high-pressure cable, which expires on December 21st this year, is, says the *Elektrotechnische Nachrichten*, not likely to be continued beyond that date. Foreign competition and the need for expansion of certain firms, are obstacles to its continuance.

Book Notices.—"Programme of the Department of Technology, City and Guilds of London Institute, 1914-15."—London: John Murray. Price 9d. net.

"Regulations for Technical Schools, Schools of Art, and Other Forms of Provision of Further Education in England and Wales."—London: Wyman & Sons, Ltd. Price 2d.

Liquidations and Dissolutions.—Accumulator Industries, Ltd.—This company is winding up voluntarily, with Mr. A. W. Sully, of 19-21, Queen Victoria Street, E.C., as liquidator. A meeting of creditors is called for to-day (August 7th), at Winchester House (hall 43), Old Broad Street, E.C.

Dry Gas Electric Fire Extinguisher Co., Ltd.—This company is winding up voluntarily, with Mr. H. Keeling, of 109, Colmore Row, Birmingham, as liquidator.

The partnership between Messrs. F. J. Allen & E. C. Beman (trading as the Electrical Supplies Co.) has been dissolved by mutual agreement. All debts will be received and paid by Mr. E. C. Beman, who will continue to carry on the business under the same style as heretofore.

Foreign and Colonial Lighting, Ltd.—A meeting will be held at 3, 4 and 5, Broad Street House, New Broad Street, E.C., on September 4th, to hear an account of the winding-up from the liquidator, Mr. W. Reacher.

Bankruptcy Proceedings.—F. Behrens (F. Burns), electrical engineer, Barnsley.—A first and final dividend of 7s. 5d. in the £ is payable on August 7th at the Official Receiver's office, 21, King Street, Wakefield.

T. Moore, electrical engineer, Headingley, Leeds.—Adjudication order, July 27th.

T. M. Woodcock, electrical engineer, Sheffield.—A first and final dividend of 7½d. in the £ is payable on August 5th, at the Official Receiver's offices, Figtree Lane, Sheffield.

W. H. Davis (General Incandescent Fittings Co.), Saltley, Birmingham.—Trustee (A. S. Culley, Official Receiver), released May 28th.

J. W. Garsden (J. W. Garsden & Co.), electrical engineers, Blackburn.—Trustee (Mr. J. Smith, 27, Ainsworth Street, Blackburn) released July 22nd.

Turbine Contracts.—Orders recently received by Messrs. Boving & Co., Ltd., include the following:—

Piracicaba Hydro-Electric Co., Brazil.—One turbine of 1,400 H.P., for 22 m. head.

Kawasugawa Hydro-Electric Co., Japan.—One turbine of 780 B.H.P., for 81 m. head.

Dominion Portland Cement Co., New Zealand.—Two main turbines, each of 1,700 H.P., for 130 ft. head; two exciter turbines of 45 B.H.P.

Anglo-Japanese Power Co.—Two spiral Francis turbines, each of 2,900 H.P., for 295 ft. head.

F. Street & Co., Oporto.—Two turbines, each of 73 H.P., for 13·2 m. head.

Pump orders have also been placed with them at Middlesbrough, Bolivia, Cairo, Wellington (N.Z.), and Nigeria for outputs up to 900 G.P.M., and heads up to 620 ft., and they have on order 18 Mendheim kilns for baking casettes, for the British Aluminium Co., Kinlochleven.

Exhibition at Manchester.—We have received the prospectus of the "Second Northern International Engineering Exhibition," which is to be held under the auspices of the Northern Engineering Industries Exhibitors' Committee at Manchester from October 29th to November 20th, 1915. The directors are Messrs. C. H. Luke and F. W. Bridges, of 196, Deansgate, Manchester, from whom particulars can be obtained.

Holidays.—The Crypto Electrical Co.—The works are closed from August 3rd until August 10th.

LIGHTING and POWER NOTES.

Aylesbury.—Loan Sanction.—Subject to B. of T. approval of the site for the generating station, the L.G.B. has informed the U.D.C. that it is prepared to sanction a loan of £21,323 for E.L. purposes. The approval of the site has now been forwarded to the L.G.B.

As the time for carrying out the scheme expires on August 7th, the Council has secured a year's extension of time from the L.G.B.

Bexhill-on-Sea.—Loan Sanction.—The L.G.B. has sanctioned the borrowing by the T.C. of £2,150 for mains for the Little Common district, and booster machinery.

Bournemouth.—Bungalow Lighting.—Electricity is being supplied to beach bungalows from the cables along the front by the Bournemouth and Poole Electricity Supply Co. There are at present 126 of these structures.

Brentford.—Workhouse Lighting.—The B. of G. has decided to have electric lighting installed, by way of experiment, in two blocks at the Workhouse Infirmary. The service will be provided, free of charge, by the Heston and Isleworth U.D.C.

Brighton.—Loan Sanction.—The T.C. has received L.G.B. sanction to loans for electricity purposes, as follows:—£5,000 for mains; £3,000 for motors for hire; £2,500 for heating and cooking apparatus; and £450 for alterations and additions to the North Road offices.

Canterbury.—Electric Vehicle Charging.—The T.C. has fixed a tariff of 1d. per unit for charging electric vehicles, except during the winter, from sunset to 9 p.m., when the charge is to be 3d. per unit, with a minimum charge of 2s. in each case.

Cardiff.—Annual Report.—In his report of the working of the Corporation electricity undertaking for the year ended March 31st last, the borough treasurer states that the income was £58,704, an increase of £5,351 on the previous year, and the gross profit was £22,768, an increase of £1,480. At the presentation of the report to the Council, Mr. Arthur Ellis, the borough electrical engineer, stated that the surplus in hand was £10,502, and the number of units sold, 6,883,797, was an increase of 656,910. At his instigation a resolution was passed providing that the profit on the undertaking should be carried to the revenue account. The department purchased from the Roath tramway power station 7,548,277 units and generated 664,177 units at its Eldon Road station.

Cassop.—Street Lighting.—The P.C. has accepted the offer of Messrs. Bell Bros., of Bowburn Colliery, to light Bowburn Village and Hengh Hall with electricity, at 45s. per 50-c.p. lamp, and 40s. per 32-c.p. lamp, per annum.

Cefn Mawr.—Proposed E.L.—A Ruthin company has informed the P.C. that it intends applying for a prov. order for E.L. at Cefn Mawr, Acrefair, and Rhosymedre, and the Council, before consenting to the application, has decided to seek further information.

Cleckheaton.—Proposed Loan.—The U.D.C. has decided to apply to the L.G.B. for sanction to borrow £8,085 for plant extensions, &c., at the electricity works, including one 400-kw. mixed-pressure turbine and direct-driven, D.C. generator, with surface condensing plant, £3,600; water filter and pipe work, £850; switchgear and connections, £500; extension boiler, with setting and superheater, £1,400; buildings and alterations, £1,000; and sundries, £735.

Connah's Quay.—Proposed E.L.—In connection with the proposed E.L. scheme, the U.D.C. has decided to include the village of Northop in the area of supply.

Continental Notes.—Austria.—The T.C. of Vienna has purchased the undertaking of the Allgemeine Oesterreichische Elektricitäts-Gesellschaft, for 11,400,000 kronen, and the company has gone into voluntary liquidation.

Finland.—According to the *Times*, the Finnish Senate is discussing the scheme for obtaining electrical power from the Imatra Waterfall, one of the largest unused water powers in Europe. The scheme provides for a yield of 300,000 H.P., and the station is expected to generate 1,600 milliards of kw.-hours per annum, or sufficient to supply the lighting, tramway and electric railway requirements of St. Petersburg and Wiborg, and also the St. Petersburg manufacturing district.

A scheme for harnessing the Volkhov Rapids, between Lakes Ladaga and Illmen, is being discussed afresh.

Russia.—A company has acquired a huge stretch of peat land near Moscow with a view to generating electricity from the peat. A generating station, said to be one of the largest in Europe, is to be erected. The current is to supply the villages and factories in the immediate neighbourhood, and is also to be transmitted to Moscow.—*Elektrotechnische Nachrichten.*

Darwen.—Annual Report.—The net profit of the electricity department during the past year was £972, against £912 in 1913. The balance was £2,261, out of which £1,000 was transferred in aid of the rates, and £70 applied towards improvements to the switchboards at the works; thus leaving a disposable balance of £1,191, out of which it is proposed to transfer a sum of £500 in aid of rates during the current year. In the case of the tramways, the year's working resulted in a net profit of £448, which reduced the deficit on this department to £1,077.

East Ham.—Annual Accounts.—The accounts of the electricity undertaking for the year ending March 31st last show a total income of £32,626, an increase of £2,402. The expenditure £20,228, was an increase of £3,136; the gross profit was £12,398, a decrease of £734 as compared with the previous 12 months. After meeting all charges, there remained a surplus at the close of the year of £955. In making any comparison between this figure and the surplus at the close of the previous year, the Electricity Committee states that it must be borne in mind that in the latter case the surplus of £1,582 was smaller to the extent of £454 by a transfer from tramways fund in respect of the adjustment of loan debit.

Eccles.—New Charges and Loans.—The T.C. is prepared to re-charge electric vehicle batteries at the rate of 1d. per unit, other than at peak load hours. The E.S. Committee has decided to reduce the charge for the supply of energy for cooking, heating and domestic purposes, other than lighting, from a sliding scale of 3d. to ½d. per unit, to a flat rate of 1d. per unit, as from April 1st last. Application is to be made to the L.G.B. for sanction to the borrowing of £4,000 for E.L. mains during the next four years; and £450 for a coal conveyor and elevator.

Edinburgh.—Annual Report.—Treasurer Macleod, in his financial statement to the Council, mentioned that the balance on the electric light account at the close of the year and available for appropriation was £3,834. The total revenue was £145,022, and the total expenditure was £141,187. The working expenditure was £79,957. Interest and sinking fund contributions amounted to £61,230. Despite price reductions, the revenue amounted practically to the total estimated on the original scale of charges.

Gillingham (Kent).—Proposed Loan.—The T.C. has applied to the L.G.B. for sanction to a loan of £5,000 for mains and services, to be increased to £7,500 in order to include sub-stations.

Gloucester.—Annual Report.—In his report on the past year's working of the Corporation electricity department, the electrical engineer, Mr. F. H. Corson, states that the revenue amounted to £15,125, an increase of £650 over the previous year, and the working expenses to £7,509, an increase of over £200. Capital charges totalled £7,021, leaving a surplus of £595, compared with last year's deficit of £106. The output was over 1,900,000 units, including private lighting, 600,000, an increase of 33,000; power, 590,000, an increase of 167,000; tramways supply, 467,000; and street lighting, 207,000.

Grimsby.—Proposed Loan.—The Lighting Committee has recommended the T.C. to apply for sanction to a loan of £24,500 for the extension of the plant at the electricity works, in addition to the £5,000 referred to in our last issue. It was mentioned that, in view of the probable industrial development of the town, a H.T. system of supply would be necessary.

Hereford.—Loan Sanction.—The T.C. has received from the L.G.B. sanction to a loan of £2,530 for electricity purposes, including £1,500 for mains.

Heston-Isleworth.—Loan Sanction.—Sanction has been received by the U.D.C. to the borrowing of £3,569 for E.L. cables, and £1,200 for prospective expenditure on mains. An electric car is to be purchased from the Opel Motor Co., at a cost of £185.

Japan.—In the town of Gifu, as the outcome of a public protest against the high rates charged for electric lighting, a number of citizens recently attempted to set fire to one of the buildings of the Electricity Co. The police intervened, and over 30 persons were arrested.

Llandyssul.—Proposed E.L.—As a result of a canvass, by which 1,151 shares have been taken up, the promoters of the E.L. undertaking have decided to engage an expert to prepare a scheme.

London.—Islington.—The B.C. has had under consideration schemes prepared by the electrical engineer for the extension of mains, and the provision of sub-stations, additional boilers, coal storage, &c., in connection with the undertaking. Mr. Albion T. Snell has been appointed at a fee of 100 guineas, to report on the scheme.

The Lambeth B.C. has been in correspondence with the South London Electric Supply Corporation with regard to the increase of price of electricity in the area, and the directors have agreed to meet the Council's representatives to discuss the matter.

Woolwich.—New Mains.—The B.C. has decided to expend £1,107 on an E.L. main from Bowling Green Row to Frances Street, and an additional main to the Royal Military Repository.

Maidenhead.—Year's Working.—The E.L. Committee reports that a profit of £370 was made on the past year's working of the T.C.'s electricity undertaking. £560 was paid out of revenue for works, which might have been charged to capital, and £1,800 was absorbed by loan charges.

Middlesex.—A letter was read at the County Council meeting on the subject of the electricity supply in bulk. The L.C.C. asked that the Council would appoint representatives to a conference, to include representatives of Surrey, Essex and Herts. The chairman (Mr. W. Regester) said the proposal they made was to deal with the matter in the same way as they did the trams. Alderman Burt said about £90,000 was spent by them on energy for the trams. They therefore would have to consider the question of the trams and the supply of current. The Council ought to make direct nomination to the conference. A member thought the whole matter ought to be considered by a Committee first, and then, after they had reported, to consider who should go to the conference, if anyone. Mr. Dobson asked if the Council could get out of their contract with the company. The Council appointed the chairman, vice-chairman, Alderman Vintsham and Mr. Marlow Reed to attend the conference and report.

Newport.—Proposed Loan.—The Electricity and Tramways Committee has recommended the T.C. to obtain a loan of £16,000 for new mains.

Norwich.—Annual Report.—According to the report of the Electricity Committee for the year ended March 31st last, the output was 7,784,695 units, an increase of 1,312,309 units over the preceding year. The total includes 4,285,242 units for power, an increase of 799.055; 2,737,075 for private lighting, an increase of 262,773 and 762,378 for public lighting, an increase of 250,481. During the year £8,004 was expended on the undertaking, including £4,063 for the completion of the public lighting. The surplus of £4,473 has been placed to the depreciation fund, from which £9,800 was written off on account of obsolete machinery, and which now stands at £9,663. The consumers number 6,221, of whom 3,878 are supplied on the free wiring system. During the year a contract for a 3,000-kw. 6,600-volt turbo-alternator was placed with Messrs. Parsons.

Plymouth.—School Lighting.—The Education Committee has decided to have electric lighting installed at Cattedown Road and Oxford Street Schools.

Penyfford.—Proposed E.L.—It is proposed to form a company for the purpose of supplying electricity to the parish, but before definite action is taken, the ratepayers have decided to ascertain whether the Hawarden R.D.C. intends taking any steps for lighting the parish.

Rochester.—Street Lighting.—The T.C. has accepted a scheme submitted by the Kent E.P. Co. for lighting the High Street. The details are:—70 lamps; capital expenditure, £570; annual cost, £548; annual cost if certain lamps are turned out at midnight, £495. A competing scheme was submitted by the Gas Co., with 53 lamps; capital expenditure, £500; annual cost, £522; annual cost if certain lamps are turned out at midnight, £473.

Ross (Herefordshire).—Street Lighting.—The U.D.C. has invited the E.L. Co. to compete with the Gas Co. for the lighting of 172 public lamps for three years from September 29th next.

South Africa.—The Mossel Bay (Cape Province) Municipality proposes to borrow £11,593 for an electric lighting scheme. —*Board of Trade Journal.*

St. Annes-on-Sea. — Promenade Lighting. — The U.D.C. has decided to proceed immediately with a scheme of electrical illuminations for the Promenade, extending over half a mile.

Street.—Prov. Order.—Messrs. Christy Bros. & Co., of Chelmsford, have informed the U.D.C. that they intend applying for a prov. order for E.L. in its area.

Sutton.—Bulk Supply.—The B. of T. has intimated its intention to authorise the County of London E.S. Co. to supply electricity in bulk to the South Metropolitan Tramways and Lighting Co.

Wallasey. — Promenade Lighting. — The borough engineer has been instructed to report upon the question of lighting the promenade.

Walsall.—New Generating Station.—A report on this matter has been presented to a special meeting of the T.C. The scheme has received Government sanction, and on the advice of the L.G.B. it is intended to complete by next summer the second part of the scheme which it was originally intended to defer till 1916. Considerable mains extensions were recommended.

Warrington.—Year's Working.—On the past year's working of the Corporation electricity undertaking, a net profit of £2,935 was made. The income from lighting supply and power supply increased by £714 and £3,283 respectively. The average price per unit for lighting was 3·47d., and for power 0·968d.

Watford.—Meter Loan Refused.—In sanctioning a loan by the U.D.C. for electricity purposes, the L.G.B. has refused to allow a sum for meters, suggesting that the cost should be met out of revenue. The electrical engineer and the chairman are to interview the L.G.B. officials with a view to the meter loan being sanctioned. Current for heating and cooking at hotels, &c., is to be supplied, subject to circumstances, at 1d. per unit.

Wednesbury.—Year's Working.—The loss on the working of the Corporation electricity undertaking last year was £552, as compared with £96 the year before. The report stated that considerable repairs were carried out during the year owing to breakdowns of gas engines, pumps and boosters. The units sold increased by 152,944. In order to meet next winter's load, it is proposed to obtain a 300-kw. converter, transformer and switchgear, at a cost of £1,086.

Whitehaven.—The General Purposes Committee has decided to light with electricity the new roads on the colliery company's housing estate, on the understanding that electricity is adopted for the domestic lighting of the houses.

Windermere.—Garden Lighting.—The U.D.C. has decided to have the Victoria Gardens illuminated by electricity.

Wrexham.—Year's Working.—The income of the T.C.'s electricity undertaking for the past year was £9,203, the gross profit was £3,651 and the net profit was £455. The output was 846,264 units.

York.—Overhead Wires.—The T.C. has applied to the B. of T. for consent to erect overhead mains from the river Ouse to the Fulford pumping station, for the transmission of electricity at 3,000 volts.

TRAMWAY and RAILWAY NOTES.

Argentina.—The plans presented by the Buenos Ayres Western Railway Co. relative to the erection of an electric power station have been approved by the Government. This station is to supply the energy required for the electrification of the company's suburban service between Plaza Once and Moreno, and the tunnel route to the Port of Buenos Ayres.—*Review of the River Plate.*

Baildon (Yorks.).—Loan Sanction.—The B. of T. has sanctioned the U.D.C.'s application for powers to borrow £21,500 for constructing a tramway from the terminus at Baildon Bridge to Lane End, Baildon. The Bradford Corporation will construct the tramway on behalf of the Council, and will lease the running powers. Electricity will be supplied by the Shipley U.D.C.

Birkenhead.—Annual Report.—The annual report of the tramways manager states that the total receipts for the past year were £68,607, an increase of £6,534 over the previous year; working expenses were £41,391; capital charges amounted to £21,503; and there was a balance of £5,712, which has been placed to the renewals fund, which now amounts to £22,655. The net profit shows an increase of £1,411, and working expenses increased by over £5,000. The number of passengers carried increased by 1,545,597.

Cardiff.—Annual Report.—The report of the borough treasurer on the working of the Corporation tramways department for the year ended March 31st last states that the traffic receipts were £142,040, an increase over the previous year of £12,776. The expenditure amounted to £99,563, an increase of £15,270. Loan charges amounted to £46,955, and the surplus was £18,594, a decrease of £1,732. Of the surplus, £6,946 was placed to the depreciation fund, and £4,800 to the relief of the rates. The depreciation fund now stands at £70,118. The passengers carried during the year numbered 31,122,962, an increase of 2,757,685, and the car-mileage was 2,966,230, against 2,614,901.

Continental Notes.—Austria.—The State Railway Administration has been experimenting with the lighting of railway carriages, with a view to the general introduction of electric lighting. Some 350 electric lighting equipments have been installed, and as a result of the experiments a printed instruction has been issued for the guidance of prospective tenderers for this class of material. It is to be obtained on application to the Nordbahndirektion, Vienna.

East Ham.—Annual Report.—The total tramway income for the year ended March 31st last was £55,747, a decrease of £2 222. The gross profit for the year was £6,741, against £12,161 for 1912-13, a decrease of £5,420. After charging interest on, and repayment of loans, and also the sum of £573 in respect of outstanding debt, there remains a deficiency of £6,238, which with the accumulated deficiency at the commencement of the year makes a total deficiency of £7,455. The Council is not, apparently, entitled to call upon the ratepayers to provide any deficiency except to the extent to which the deficiency exceeds the amount standing to the credit of the reserve or depreciation and renewals account, *i.e.*, £4,002.

Edinburgh.—New Tramway.—The T.C. is to take steps to obtain power to construct a tramway to Colinton, *via* Craiglockhart.

Gloucester.—Annual Report.—The general manager, Mr. F. H. Corson, reporting on the working of the Corporation tramways undertaking during the past year, states that the passengers carried numbered 4,415,555, and the car mileage totalled 638,646. The total revenue was £18,018, an increase of £670 over the previous year, and the working expenses were £13,881, an increase of £100. Capital expenditure amounted to £5,246, and £4,370 was tranferred to the tramways account from the rates, to meet loan charges.

London.—L.C.C.—The Southwark B.C. Works Committee has no objection to the proposal to connect the Blackfriars Road tramway with the tramway terminus at Waterloo Station, *via* New Cut and Great Charlotte Street. The Westminster City Council has agreed to interview the Highways Committee of the L.C.C. in regard to the proposal to connect up the tramways at Victoria and Westminster Bridge *via* Victoria Street, Parliament Square, &c., although no support can be relied on from it.

On Monday evening an L.C.C. tramcar collided with a stationary car in King William Street, Greenwich. Nineteen passengers were slightly injured, and both cars were considerably damaged.

Manchester. — Traffic Report.—The question of traffic congestion in Manchester, which recently formed the subject of an exhaustive report by Mr. J. M. McElroy, the tramway manager, is now dealt with in an equally full report by Mr. J. H. Thewlis, chairman of the Watch Committee, and Mr. Robert Peacock, chief constable, who have visited London, Paris, Berlin, Dresden, Munich, Hamburg, Vienna, New York, Chicago, Philadelphia, Boston, Toronto and Montreal. In regard to the tramways, the report states that the effect of the withdrawal from the central area of two-thirds of the cars using the tracks therein, would at once considerably relieve the normal street traffic. The time has arrived when the Watch Committee must seriously consider the extent of the tram service in the central area, the obstruction caused to general traffic, and also the public convenience.

Oldham.—A Report.—The Tramways Committee of the Oldham Corporation on July 30th considered and revised the draft report on the chairman's inquiry into the administration of the tramways department, and it is understood that the Committee finds that the charges against the administration are for the most part groundless, and no blame is attached to the manager.

Salford.—New Loans.—The T.C. proposes to borrow £28,073 for new tramcars, of which £7,640 is for 12 car bodies without covered tops, but with vestibule ends, and £9,560 for 12 car bodies with covered tops and vestibule ends. The

Electricity and Tramways Committee has also recommended the Council to borrow £1,398 for an A.C.-D.C. switchboard, and £914 for a three-phase extra high-pressure switchboard.

South Shields.—Electric 'Buses.—A service of electric omnibuses, to work in conjunction with the tramways, was inaugurated last week by the T.C. The vehicles, constructed by Messrs. Edison Accumulators, Ltd., were described recently in our pages, and are to maintain a 15 minutes' service over a route of 1¼ miles. At the opening ceremony, Mr. Robson, the tramways manager, stated that the power cost would be very little more than 1d. per mile, while a similar vehicle driven by petrol would cost 3d. per mile. They would also obtain quieter and smoother running, and would open a new source of revenue for the electricity and tramways departments.

TELEGRAPH and TELEPHONE NOTES.

Argentina.—The Government of the Province of Buenos Ayres has received an offer for the renting of the provincial telegraphs by a company to be formed, with a capital of $5,000,000. The profits would be divided between the Government and the shareholders.—*Review of the River Plate.*

Atlantic Cables Cut.—The cutting of the cables of the Commercial and German Atlantic Cable Companies at the Azores is announced at the offices of the Commercial Cable Co. The cutting of the cables between the Azores and the Continent in no way affects the main body of the commercial cables, and communication between the United States and England is still intact. The Commercial Cable officials state that the cutting was done by British vessels.

Automobile Wireless Telegraph Stations.—What is claimed to be a notable advance in the construction of portable wireless sets for army field service has recently been made by the Signal Corps of the United States Army. For the next field operations of the Army, there is now available a motor wagon equipped with wireless telegraph apparatus which can be set up for use in 12 minutes, and can send messages within a radius of no less than 800 miles under favourable conditions. The vehicle was built specially for the Signal Corps, by the White Co., of Cleveland. In tests that have already been made, the set is stated to have received messages from points 2,500 miles distant. The great range of the equipment and the speed with which it can be brought into action, are said to be due to the employment of a powerful electric generator driven through a train of gears by the 30-H.P. petrol engine of the vehicle. The antennæ are of the umbrella type, mounted at the top of an 85-ft. mast, which is built in nine sections. The first, or top section, is raised by hand, but the others are lifted by a block and tackle suspended from struts mounted on a platform on the roof of the vehicle, which can be quickly detached when not in use. When disassembled the nine sections of the mast are carried in long compartments built along both sides of the motor-wagon. The counterpoise or artificial earth consists of heavy insulated wires radiating from a common centre, to which is attached the earth wire of the wireless set. Preliminary tests with a wireless receiving equipment installed by the Marconi Wireless Telegraph Co. have also recently been made between the American Building Wireless Station in Baltimore, and a motor-wagon used by the Electrical Commission for pumping water from manholes throughout the city. Wireless signals were received by the equipment as far as seven miles in the suburbs, also while the car was running, or standing at the manholes in the city limits. The equipment consists of a standard Marconi receiving apparatus, similar in detail to the equipment used on board merchant vessels. The receiving antenna consists of about 25 insulated wires hung in the roof of the car. The frame of the vehicle acts as the earth connection, although it is insulated from the ground by the rubber tires. The Fire Brigade Authorities of Baltimore are interesting themselves in the tests, as it will probably be possible to equip fire engines and other apparatus with the receiving instruments, so that when sent out, they could be instantly recalled, saving time and trouble and increasing fire protection to the city by reason of the engines always being in touch with headquarters.

Experimental Wireless Stations.—The Postmaster-General has issued instructions for the closing of all experimental wireless telegraph stations in this country, and will be glad to receive from any quarter information of any wireless station which may be observed to be kept up in contravention of his orders.

The formation of a volunteer corps of the 2,000 holders of licences for experiments in wireless telegraphy has been suggested by Mr. W. Le Queux to the Postmaster-General.

Foreign Telegrams.—Ordinary telegrams for places abroad and radio-telegrams, however addressed, are now only accepted if written in plain English or French, and at sender's risk. They will be subject to censorship.

Telegraphs and Telephones on the Continent.—Telephonic communication was stopped between the various Continental nations involved in the war towards the end of last week, to prevent the leakage of news. Communication by telephone between London and Paris ceased on Monday, and delays in telegrams to the Continent and to the Far East were announced on Saturday.

Wireless in Warfare.—It is reported that the German wireless station at Swakopmund has increased its power and is sending out signals intended to "jam" those issued from British stations.

Wireless Telegraph Regulations.—The Government has assumed control of all wireless telegraph stations in the British Isles, and the Board of Admiralty has prohibited the use of wireless telegraphy by merchant vessels in the territorial waters of the United Kingdom and the Channel Isles. The wireless apparatus is to be dismantled on any ship entering a port or harbour. Similar precautions have been taken by the Governments of British Dominions and Colonies.

CONTRACTS OPEN and CLOSED.

OPEN.

Argentina.—Rauch.—The City Council has authorised the Mayor to call for tenders for the construction of electricity works.

Australia.—Sydney.—August 31st. Sydney Harbour Trust. Four electrically-operated semi-portable travelling cranes. Forms of tender from Mr. H. F. Norrie, Secretary to the Trust, Sydney.

September 14th. Municipal Council. 22,500 yd. of 33,000-volt, three-core paper-insulated, lead-covered cable. Deposit £200. Specification, 10s. 6d., from the City Electrical Engineer; a copy may be seen at the B. of T. Commercial Intelligence Dept., London.

Richmond.—Nov. 30th. Refuse destructor and auxiliary plant. Specification, &c., from Mr. C. C. Blazey, Town Clerk, Richmond, Victoria.

Brisbane.—September 2nd. Measuring instruments, protectors and parts, telephone and telegraph instruments, for the Postmaster-General. See "Official Notices" July 31st.

Adelaide.—Sept. 9th and 23rd. Telephone material, microphones, protectors, &c., switchboards, bells and cells, for the Postmaster-General. See "Official Notices" July 31st and to-day.

Adelaide Tramways Trust.—September 1st. One booster set, with cables and spares.—*Australian Mining Standard.*

Melbourne.—August 18th. Electricity recording meters and carbon brushes, for the Melbourne City Council. See "Official Notices" July 31st.

September 23rd. 102 electric motors, starters, switchboards and wiring for installing electrical drive at Messrs. Sands & McDougall, printers. Mr. M. C. Coates, consulting engineer.—*Tenders.*

Victorian Railways Department.—October 7th. Motors and switchgear, and motor-driven air compressors for the Ballarat and Bendigo workshops.

Belfast.—August 24th. Corporation. One electric motor tower-wagon. See "Official Notices" July 31st.

Birkenhead.—August 10th. Corporation. Cooling tower. See "Official Notices" July 24th.

Bulgaria.—The Bulgarian Administration of Finances, in Sofia, is inviting tenders until the 13th inst. for the installation and equipment of a central station for lighting and power purposes at the port of Bourgas.

Earsdon (Northumberland).—August 15th. U.D.C. For the supply of poles, cables, lamps, &c., in connection with the extension of public lighting. Particulars from Mr. J. R. MacMillen, Surveyor, Council Offices, Shiremoor.

Eastbourne.—August 18th. Corporation. Main machine and feeder switchboard for the electricity works See "Official Notices" July 24th.

Edinburgh.—August 17th. Corporation. Extensions to the electric lighting installation at the City Museum. Specification from the Engineer's office, Dewar Place.

France.—The French State Railway Authorities (Bureaux du Service Electrique, 3me. Division) in Paris (72, Rue de Rome) are inviting tenders until the 25th inst. for the installation of the principal and secondary mains required in connection with the electric lighting and power installation at the car-sheds at Auteuil and La Garenne, near Paris.

Kingston-upon-Hull.—August 22nd. Corporation. Electrical fittings for the Guildhall Council Chamber, &c. See "Official Notices" July 24th.

Lisnakea.—August 15th. Wiring the workhouse and auxiliary buildings with necessary fittings, &c., for the B. of G. Specifications from Mr. J. O'R. Hoey, Clerk.

London.—August 12th. Office of Works. Supply of electric clocks on a rental basis in the London districts, for the Commissioners of His Majesty's Works. Particulars from the Controller of Supplies, H.M. Office of Works, 18, Queen Anne's Gate, S.W.

L.C.C.—September 8th. Cables, H.T. and L.T., and laying stoneware ducts (tramways). See "Official Notices" to-day.

Matlock.—August 8th. U.D.C. 1,967 yards of patent steel wire tramway cable. Specifications, &c., from C. P. Foster, Esq., Tramway Manager, Town Hall.

Newport (Mon.).—August 17th. Corporation. Converting plant, &c. See "Official Notices" July 31st.

Nuneaton.—August 11th. Corporation. Underground cables. See "Official Notices" July 31st.

Oldham.—August 16th. Corporation. D.C. motor-generator and extension to E H T. switchboard. See "Official Notices" July 24th.

August 24th. Corporation. Three economisers and three induced-draught fans and motors. See "Official Notices" July 31st.

August 24th. Corporation. Storage battery, reversible booster and switchgear. See "Official Notices" to-day.

Palmas (Majorca).—Tenders are invited by the Compañia General de Tranvias Electricos Interurbanos de Palma de Mallorca, for the rolling stock and permanent way material required for the whole of their line.

Rugby.—August 12th. Electric light installation at the Harborough Magna Hospital, for the Joint Hospital Board. Mr. M. E. T. Wratislaw, Clerk, 16, Church Street.

Spain.—Tenders have been invited by the municipal authorities of Bustaviejo (province of Madrid) for the concession for the electric lighting of the town.

The Spanish Ministry of Public Works (Ministerio de Fomento) in Madrid, is inviting tenders until September 9th for the concession for the construction and working of an electric tramway between Ferrol and Santa Maria de Neda.

Stockton (N.S.W.).—August 15th. Corporation. Electric lighting for a period of 10 years. The Municipality of Stockton. About 80 lights. Specifications from Mr. J. W. Oldham, Town Clerk.

Sunderland.—August 18th. Corporation. Two 1,500-kw. motor-generators or rotaries. See "Official Notices" July 31st.

Swinton and Pendlebury.—August 19th. U.D.C. Cables, fittings, &c. See "Official Notices" July 31st.

Walsall.—August 11th. Corporation. Coal conveyer and measuring apparatus, jib coaling crane, ash-handling plant, travelling crane. See "Official Notices" July 17th.

August 12th. Corporation. 7,000 tons of rough slack coal for the electricity works. Particulars from Mr. H. A. Howie, Engineer and Manager, Wolverhampton Street.

Walthamstow.—August 19th. U.D.C. Supply and delivery of tramway rails, castings, fishplates, &c. Forms of tender from Mr. E. Morley, Surveyor to the Council.

West Hartlepool.—August 17th. Corporation. Machine tools for tramways depôt workshops. See "Official Notices" July 31st.

CLOSED.

Aylesbury.—The U.D.C. has received the following tenders for accumulators:—

	Batteries of		
	About 500 amps.	About 800 amps.	About 560 amps., installed with cells to enable additional plates to be added to increase the capacity to 800 amps.
E. T. Mackrill & Sons	£988	£1,415	£1,142 (accepted)
Premier Accumulator Co., Ltd. ..	969	1,434	1,190
Pritchett & Gold, Ltd.	996	1,478	1,151
Chloride Electrical Storage Co. ..	998	1,495	1,152
D P. Battery Co.	1,010	1,411	1 150
Electrical Power Storage Co., Ltd.	1,015	1,527	11,179
Hart Accumulator Co., Ltd. ..	1,031	1,486	1,185
Tudor Accumulator Co., Ltd. ..	1,043	1,545	1,250

The Council has also accepted the tender of Messrs. Johnson and Phillips, Ltd., for a switchboard, at £408 15s., including £24 for additional voltmeters. Tenders for cables are deferred pending definite agreements with firms requiring large supplies of current for power.

The tender of Messrs. Broom & Wade, Ltd., has been accepted for pumping machinery, with a 4-kw. electric dynamo, &c., at £4,292.

Bexley.—The U.D.C. has provisionally accepted the tender of the British Insulated & Helsby Cables, Ltd., for 3,500 yards of feeder cable for the Foot's Cray district, at £1,200.

Birkenhead.—The T.C. has accepted the following tenders for coal for the generating station:—

Hulton Colliery Co., Ltd.—10,000 tons.
Mr. C. Wass.—1,000 tons.
W. B. Dobjll & Co., Ltd.—1,000 tons.

Bolton.—The Electricity Committee has accepted the tender of Messrs. J. B. Scholes & Sons for 15,000 tons of coal, and provisionally accepted the following tenders:—

British Westinghouse Co., Ltd.—Two 1,000-kw. and two 600-kw. rotary converters, for Spa Road works and Bradshawgate sub-station.
British Thomson-Houston Co.—Extra-high-tension three-phase switchgear.
Johnson & Phillips.—High-tension single-phase switchgear, for Back o'th'-Bank generating station and Bradshawgate sub-station.

Canterbury.—The T.C. has accepted the following tenders for coal for the electricity works:—

Wm. Cory & Son.—1,800 tons of Rochester house screenings, 17s. 10d. per ton.
J. Eveson Coal & Coke Co., Ltd.—400 tons of Glyc Merther Welsh steam coal, £1 7s. per ton.

Colne.—Messrs. Hartley & Leek have received contracts for the installation work at the New Hippodrome (288 points), and for lighting and bells at the Commercial Hotel.

Croydon.—The T.C. has accepted the offer of Edison Accumulators, Ltd., at £516, for the supply of an Arrol-Johnston chassis for a motor vehicle for the Electricity Department. The tender of Wm. Cory & Sons, Ltd., has also been accepted for 15,000 tons of either Muirfield peas at 16/3 per ton, or Hill House washed peas at 15/11 per ton, at the Electricity Committee's option.

Derby.—The T.C. has accepted the tender of the Rees Roturbo Co., at £193, for a boiler feed pump; and that of Messrs. Mossay & Co., at £297, for an electric vehicle. The E.L. Committee recommends that the tender of Messrs. Aiton & Co., at £387 10s., for pipework, be accepted.

Eccles.—The Electricity Committee has accepted the tender of the Earl of Ellesmere for 12 months' supply of slack, at 10s. 9d. per ton.

Erith.—The U.D.C. has accepted the following tenders for coal for the electricity works:—

Beadle Bros., Ltd.—South Hetton coal for a year, 14s. 6d. per ton.
H. W. Clarke & Co.—Best wharf screenings for a year, 14s. 5d. per ton.

Lancaster.—The T.C. has accepted the tender of the Lune Valley Engineering Co., for a dynamo, battery, &c., for the motor fire engine, at £32.

Leeds.—The Corporation has accepted the tender of Messrs. Siemens Bros. Dynamo Works, Ltd., for a 13,000-kw. turbo-alternator with condensing plant, for the Whitehall Road generating station, at a cost of £34,160, subject to borrowing powers being obtained. Considerable discussion took place on the proposal, Mr. Foster objecting to part of the contract (for the turbine) being let to a Swiss instead of a British firm, but it was finally carried by a large majority.

Leyton.—The U.D.C. has accepted the tender of Mr. A. C. Brown, for £32, for a fire-alarm indicator, switchboard and accessories.

London.—WANDSWORTH.—The B.C. has provisionally accepted the tender of Messrs. J. A. Henderson & Co., at £103, for installing electric light at the Balham Baths.

Luton.—The Electricity Committee has accepted the tender of Messrs. Mechan & Sons, Ltd., for £746, for a coal elevator and conveyer.

Salford.—The T.C. has accepted the following tenders for the supply of materials and stores during the period ending March 31st next:—

Stern Sonneborn Oil Co., Ltd.—Russian white oil, £50.
G. Painter & Co.—Rubber insertion, ditto rings, and brass joint-rings, £21 6s. 11d.
H. G. Mabbs.—Motor starters, £375 18s.
Le Carbone.—Motor carbon brushes, £95.
Ferranti, Ltd., General Electric Co., Ltd.—Alternating-current meters, £182 14s.
Chamberlain & Hookham, Ltd.—Continuous-current meters, £810 12s.
W. T. Henley's Telegraph Works Co., Ltd.—Rubber strip, £48 10s.
G. Hattersley & Sons, Ltd.—Plain white tape, £16.
Pirelli, Ltd.—Rubber gloves and rubber caps for cables, £11.
Electrical Engineering and Equipment Co., Ltd., and W. T. Glover & Co., Ltd.—Twin and multiple-core cable, £81; concentric cable for working pressure up to 660 volts, £143; ditto, up to 3,300 volts, £80; extra-high-tension three-core cable, £1,515.
W. T. Glover & Co., Ltd.—Rubber-covered cable for working pressure not exceeding 660 volts, £78; ditto, not exceeding 250 volts, £70; twin flexible cable, £20; rubber-covered cable for working pressure not exceeding 3,300 volts, and ditto for working pressure not exceeding 6,600 volts, at schedule prices.
Brush Electrical Eng. Co., Ltd.—12 car bodies without covered tops but with vestibule ends, £7,641; 12 car bodies with covered tops and vestibule ends, £9,561.
The J. G. Brill Co.—48 trucks, £3,263.
British Westinghouse Elec. and Mfg. Co., Ltd.—12 car electrical equipment sets, £3,048.
Dick, Kerr & Co., Ltd.—10 car electrical equipment sets, £2,720; 44 controllers, £1,474.
Siemens Bros. Dynamo Works, Ltd.—Two car electrical equipment sets, £441; four controllers, £127.
F. M. Prockter & Co., Ltd.—Supply and erection of three suspended iron gangways at the central car depôt, £307.
British Westinghouse Elec. and Mfg. Co., Ltd.—Extension of high-tension switchgear and supply of control panels in connection with 5,000-kw. turbo-alternator, £307.
J. Peach.—Three 170-kw. motor-alternators, with switchgear, £270.
Bertram Thomas.—Three-phase continuous-current switchboard (including £30 for instruments), £1,398.
British Westinghouse Elec. and Mfg. Co., Ltd.—Three-phase extra-high-pressure switchboard, £914.
R. H. Carlisle & Co., Ltd.—16-h.p. Darracq motor-car, £318 15s.

The following tenders have been accepted for coal for the Electricity Department :—

Clifton and Kersley Coal Co., Ltd., 1,800 tons of No. 2 best washed slack 12s. per ton; A. Knowles & Sons, Ltd., 8,000 tons of best washed slack, 12s. per ton; Earl of Ellesmere, 3,000 tons of Bridgewater coal, 12s. per ton, and 4,500 tons of best washed slack, 12s. 3d. per ton.

Swansea.—The B.C. has accepted the following tenders :

British Westinghouse Co.—Main generating station switchgear, £1,377.
Ferguson, Pailin & Co.—Sub-station switchgear, £547.

Wallasey.—The tender of the Brush Electrical Engineering Co. has been accepted by the Corporation for the supply of six double-deck cars with top covers, complete with trucks and electrical equipment.

Walsall.—In connection with the new generating station the Electricity Committee has accepted the following tenders :—

W. Kendrick & Son, Walsall.—Buildings, £9,214.
Belliss & Morcom, Birmingham.—Turbines, alternators, &c., £17,448.
Babcock & Wilcox.—Boiler-house plant, £20,124.

Worthing.—The T.C. has received the following tenders for the supply of cables and accessories :—

W. T. Glover & Co., Ltd.	£430
Union Cable Co., Ltd.	421
Siemens Bros. & Co., Ltd.	419
W. T. Henley's Telegraph Works Co., Ltd.	415
Callender's Cable & Construction Co., Ltd. (accepted)	406

The tender of the Main Colliery Co., Ltd., for 300 tons of Dynevor Duffryn (60 per cent. large) coal, at 21s. 8d. per ton, has been accepted.

York.—The T.C. has accepted the following tenders :—

Rotary converter and transformers, £2,794.—General Electric Co.
Switchgear, £175.—B.T.H. Co.
Erection of sub-station, £571.—H. E. Turner & Son.

INDUCTION REGULATORS AS PHASE DISPLACERS.

For the testing and calibration of A.C. watt-hour meters, and also for other laboratory purposes, it is frequently necessary to obtain an electromotive force which, whilst synchronous with that of the generator or supply, can be caused to have any desired phase relation to the latter. It should be of the same order of magnitude as the supply voltage, and its value should be unaffected by alterations in its phase.

By means of choking coils and static condensers, it is possible to cause the E.M.F. impressed upon any apparatus to lead or lag respectively in relation to the supply, but the method has the following serious limitations where any considerable range of phase variation is necessary :—

(*a*) A large number of expensive choking coils, condensers and resistances are necessary.

(*b*) The connections often become complicated.

(*c*) The voltage impressed upon the apparatus is much below that of the supply.

(*d*) Every adjustment of the phase alters the impressed voltage, and in order to obtain any given combination of phase and voltage a highly complicated calculation is necessary, involving serious loss of time.

(*e*) Fine adjustment is difficult.

To overcome these difficulties, a small polyphase induction regulator may be used consisting of a standard slip-ring induction motor without brush-lifting and short-circuiting gear. The "rotor" never performs a complete revolution, but its position in relation to the stator must be accurately adjustable by means of a hand-lever. It is then possible to obtain any desired phase relation, and with an infinite number of gradations. The adjustment is simple in the extreme, and involves no alteration of any of the electrical connections, or any calculation whatever ; the impressed voltage is independent of the phase, and is only slightly affected by variations of the load, whilst the secondary can be wound for any desired voltage. The efficiency is very high, as the regulator is practically nothing but a three-phase transformer with means for moving one of the windings. As a rule the "rotor" constitutes the primary winding, and it can be wound either two-phase or three-phase, although the former is seldom required. (As pointed out below, a single-phase induction regulator has different characteristics to a polyphase one.) The secondary can, however, be wound single-phase, two-phase, three-phase, or six-phase, three-phase being by far the most usual type of winding.

That is to say, the rotor may be either single-phase or polyphase, but that if phase-displacement is to be effected, the primary must be wound polyphase, in order that a rotary field may be produced.

Three-phase stators can be provided with six terminals to enable the windings to be connected either in star or in delta ; it is then possible to obtain the full K.V.A. output of the regulator at either of two voltages. It is also possible to provide tappings on the secondary windings so that reduced voltages may be available. The machine may, therefore, if suitably constructed, be made when necessary to perform four distinct functions, viz. :—

(*a*) Phase displacement between primary and secondary.

(*b*) Phase conversion if, say, the primary be wound three-phase and the secondary two-phase or single-phase.

(*c*) Voltage transformation, if the secondary be wound for a different pressure to that of the supply.

(*d*) Voltage regulation, by means of star-delta connections and tappings.

An induction regulator for laboratory purposes is, however, usually provided with three-phase windings of equal voltage on both primary and secondary, and with only three terminals for the rotor and three for the stator ; its sole function is thus that of phase displacement. There is no "copper" connection between the primary and secondary sides.

In order to appreciate the principle and characteristics of the induction regulator when used as a displacer, it is necessary to distinguish clearly between such phase-shifters and—

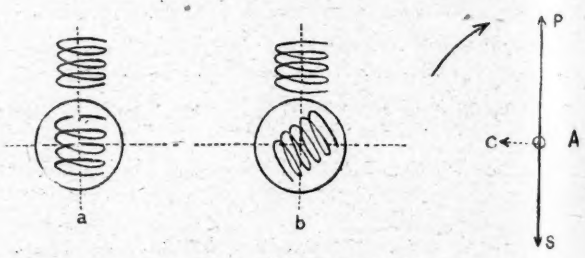


Fig. 1.

1. The three-phase induction regulator when applied as a booster.

2. The single-phase induction regulator.

In the appended figs. 1a and 1b a single-phase induction regulator is depicted diagrammatically, whilst fig. 1A represents the vector diagram with open secondary. When, as in fig. 1a, the axes of the primary and secondary are coincident, the maximum voltage will be induced in the secondary, the system resembling that of an ordinary static transformer. O P represents primary impressed E.M.F., O C, the magnetising current, lags approximately 90° behind this, and the magnetic flux is also in phase with O C. As the secondary E.M.F. lags 90° behind the flux it will be represented by O S, which is 180° behind O P, and by transposition of the connections can be brought into phase with O P. The primary and secondary voltages may, therefore, as in an ordinary transformer, be regarded as coincident in phase. The flux being alternating in magnitude and fixed in position (*i.e.*, not a constant rotating field), any angular displacement of the rotor as in fig. 1b, will not affect this phase relation, but the whole of the flux produced by the primary will then no longer pass through the secondary, and the magnitude of the voltage O S induced in the latter will be reduced in proportion to this reduction of effective secondary flux. If the rotor be moved round until its axis is horizontal, no flux will pass through the secondary, and no E.M.F. will be induced.

The functions of the single-phase induction regulator are therefore limited to that of producing a voltage variable at will from zero to a maximum, but always in phase with that impressed upon the primary.

Fig. 2a represents a three-phase induction regulator with the axes of the three primary phase-windings coincident

with those of the secondary. If any one phase be regarded separately, fig. 1A will still represent its vector diagram, and fig. 2A can be drawn for the complete three-phase system.

There is, however, the essential difference between the single-phase and three-phase machines that whereas the field of the former is alternating in magnitude and fixed in position, that of the latter is approximately constant in magnitude, but rotates in space. It follows that, into

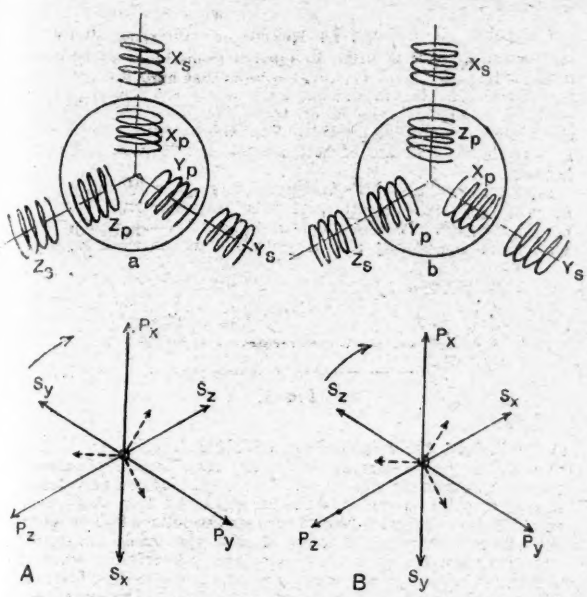


FIG. 2.

whatever position the rotor may be turned, the secondary will never escape being cut by the full magnetic flux as this revolves. Consequently the E.M.F. induced in the secondary will be independent of the rotor position, and will in effect be constant.

On the other hand, angular displacement of the rotor will alter the phase of the secondary E.M.F. Assume, for instance, that the rotor is moved through an angle of 120° as in fig. 2b. Secondary x_s will now be opposite primary zp, and its E.M.F. will, therefore, be 180° behind that impressed upon zp, instead of 180° behind that impressed upon xp; that is to say, that it is 120° later in phase than before the rotor

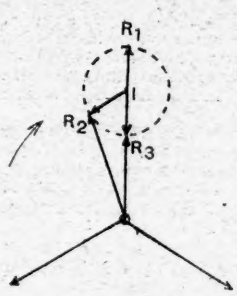


FIG. 3.

was moved. Similarly, each of the other secondary phases is retarded 120° by the movement, and the vector diagram, fig. 2B, now represents the altered relations.

It is clear also that for any other or intermediate position the phase of the secondary E.M.F. is determined by the position of the rotor in relation to the stator, its magnitude remaining constant.

Misconception is sometimes caused by the fact that three-phase induction regulators are in common use as voltage regulators on feeders, rotary converters, &c., and that single-phase induction regulators are used for this purpose on electric locomotives. It should be pointed out, however, that the voltage in the secondary of a three-phase induction regulator when used for pressure regulation, does not vary. The secondary is wound only for the difference between the minimum and maximum voltages required and is connected in series with the circuit which is to be controlled, whereas there is no copper connection between the primary and secondary of a phase displacer.

With the secondary connected in series with the line, the vector diagram of one-phase is as shown in fig. 3, where O I represents impressed voltage, I R represents secondary voltage or boost, and O R represents resultant voltage impressed on feeder or converter. The boost remains constant, but by altering its phase in relation to the primary E. M. F. the resultant voltage can be varied between O R_1 and O R_3.

The two applications of the induction regulator are therefore in no wise inconsistent.

THE PREMIUM WAGES SYSTEM.

THE premium or bonus mode of remunerating industrial labour has met with much favour, and its adoption is often urged as one of the panaceas for mitigating the antagonism that exists between capital and labour. The principle of the premium method as generally practised is that standard times and rates, which are imposed by the rate-fixing department of the particular industry, are set for various descriptions of work or output, and that if the work be completed satisfactorily in less than the standard period, the workman receives a premium or bonus, which is computed in different ways according to the conditions adopted, he, in any case, always receiving his fixed hourly rate of wager. Let us notice some of the conditions, and suppose that the standard time fixed for a certain line is 100 hours, that the work is completed in 90 hours, and passed by the inspector, that the hourly rate is 9d. and that the premium payable is one-third of any saving :—

90 hours at 9d.	810d. time work,
100 hours' standard time	
90 hours' actual time	
10 hours' saving, one-third of which is 3⅓ hours at 9d.	30d. premium.
	840d. total

which is equivalent to ($\frac{840}{90}$), 9·33d. per hour.

On similar data, except that half of the saving be payable, we have—

90 hours at 9d.	810d. time work.
10 hours' saving, half of which is 5 at 9d.	45d. premium.
	855d. total

which is equivalent to ($\frac{855}{90}$) 9·50d. per hour.

In the third instance we shall assume that the amount of the premium to which the workman is entitled bears the same ratio to the fixed rate as the actual time occupied bears to the standard period—

90 hours at 9d.	810d. time work.
10 hours' saving, which is 10 per cent. standard time, and 10 per cent. of 810d. is	81d. premium.
	891d. total

which is equivalent to ($\frac{891}{90}$), 9·90d. per hour.

Here the value of the increased exertion or intensity of labour of the workman is in the first and second instances assessed at ⅓ or ½ of the saving of time, which is calculated at the time rate, whilst in the third illustration he receives a premium on the basis indicated of $\frac{1}{10}$th of the value of the time work.

In what is usually termed the fixed premium system, the premium rate is fixed, and the workman is paid for the actual number of hours saved computed at that rate. If this rate be 7d. in the foregoing circumstances, he would receive :—

90 hours at 9d.	810d. time work.
10 hours at 7d.	70d. premium.
	880d. total

which is equivalent to 9·77d. per hour.

The opposition to the premium scheme in many instances is due, among other causes, to the difference of opinion that manifests itself in relation to the apportionment of the saving as between employer and employé, the workman often declaring that what he saves he should be paid for in full, the bonus, otherwise, being more of the nature of a sop.

The object of the premium system is, of course, to obtain increased production at less manufacturing cost, and naturally with a less ratio of on-cost to production.

NOTES.

Copper.—Copper having been declared contraband by the British Government, its export is forbidden; cargoes of the metal destined for home ports have been transferred from the ships to barges by the Government, and prices have gone up rapidly, dealers on Wednesday asking £70 a ton, whereas the price was under £60 a week ago. Very little copper is available, and there is a prospect of shortage due to the exodus of foreign labour from the United States.

Underwriters' Label Service.—The label service of the Underwriters' Laboratories of Chicago was recently explained by Mr. A. R. Small, superintendent of the label service of the laboratories. The labels are furnished to manufacturers of various classes of goods, electrical and otherwise, as the result of factory inspection. The service now covers over 70 devices and materials, of which 25 are electrical. The label service started with rubber-covered wire, rigid conduit being the next fitting to be provided with labels. The label means the actual examination of the device at the factory of the maker, and implies from 95 to 99 per cent. of compliance with standard specifications.

In the case of rigid conduit, an inspector from the Underwriters' Laboratories visits the factory four times a week in busy times. He may stay from half an hour to six hours. All inspectors are governed by very explicit instructions as to their duties. In the line of rubber-covered wire, 35 factories in the United States and Canada subscribe to the label service of the Underwriters' Laboratories. All of these produce new code wire. The rubber-covered wire factories are inspected about five times in two weeks. Manufacturers are required to make tests themselves, and the inspector has authority to re-test any new code wire in the factory. Many tests are made by inspectors, and in ways that the manufacturer cannot anticipate. If the manufacturer is found to be weak on any point, he is required to improve his material in that respect.

The message of the label to dealers and contractors is that competitors are complying at least with the minimum requirements. The manufacturers will note that all inspection work is done at the factory, which is desirable in a number of ways. In other respects the label conveys to the manufacturers a message of distinct business advantage.

Last year the number of Underwriters' Laboratories labels increased 33 per cent. over the year before. The service has justified itself. The electrical fraternity has been more active than the other industries in supporting the work of the Underwriters' Laboratories, and in turn the laboratories seek to co-operate with the electrical industry.

The expense of conducting the Underwriters' Laboratories is borne by the insurance companies, so far as the building and equipment are concerned. The pay roll is met out of the receipts from the clients of the laboratories. No charge is made to manufacturers for the overhead expense of the laboratories. Labels are furnished at a flat rate, there being no discount for quantity. Rebates are made at the end of the year if it is found that service to any particular line has been rendered at a less expense than had been anticipated. The idea is to charge for the labels what the inspection service actually costs to each line of an industry, as rubber-covered wire, conduit, snap switches, &c., the different lines being figured separately. In any event, it is not planned that the label service shall cost more than 1 per cent. of the manufacturing cost.—*Electrical World.*

Hydroelectric Plant Operated without an Attendant.—The Greenfield (Mass.) Electric Light and Power Co. has a 3,000-KW. steam plant situated on the bank of a small stream. Water from this stream is used for boiler-feed and condensing purposes, a pond being formed by a dam. During the year 1913 it became apparent that the dam (an ancient log structure) would have to be renewed. It was therefore decided to build a concrete gravity type of dam primarily for securing the water supply of the steam plant.

Investigation seemed to show that a small amount of power could be generated in connection with the dam, provided the operating expense could be kept at a low value. After due deliberation a 24-in. double-runner horizontal waterwheel was installed and belted to a 100-H.P. three-phase, 2,300-volt squirrel-cage induction motor, the motor being driven above synchronous speed so as to operate as an induction generator.

The waterwheel is controlled by a governor which holds the no-load speed about 15 per cent. above normal, so that while normally the wheel runs at full gate opening, if the load drops off for any reason, the set will not run away.

The motor is connected through an automatic switch and meter to the 2,300-volt distribution line of the company right at the plant. Ordinarily there is sufficient load on this line to absorb the output of the induction generator. At times of light load the output of the generator is fed back into the main station bus.

If the switch on this feeder at the main station should open for any reason, the induction generator loses its excitation but keeps right on running. When the switch is closed the generator becomes energised and immediately picks up its portion of the load. The process of starting up is simplicity itself; the wheel being started and the machine brought up to approximately synchronous speed, the switch is closed and the operation is complete. Provision is made for operating one runner of the wheel separately in times of low water.

The normal attendance of this plant is limited to a visit three times a day, at shift changes in the main plant. The operator stops at the plant on his way to work, reads the meters, feels the bearings and observes the general condition of the machinery, racks, &c. The plant was placed in operation on January 1st, and is fulfilling all expectations as to reliability and low operating costs.

The dam has a height of 11½ ft., including flashboards, and a spillway of 160 ft. The wheel chamber is built integral with it at one end and the generator is housed in a brick building adjacent to the wheel chamber, the wheel shaft running through a stuffing-box into the generator room.

The dam and building were built under the direction of Mr. H. A. Moody, hydraulic engineer on the staff of the company.—*Electrical World.*

Centrifugal Effects in Belting.—Referring in *Power* to the tradition that belts, to operate properly, must be given initial tension, Mr. W. F. Schaphorst admits that hard, stiff, uncared-for belts need initial tension, but belts should not be stiff; in the pliable state belts grip the pulleys to such an extent that extremely slack running is often possible. The chief advantages of slack belts are increase of arc of belt contact, and decrease in bearing friction.

Fig. 1 shows a proportion commonly observed in practice, namely, a 4-ft. driving pulley, a 1-ft. driven pulley and 20 to 25 ft. between centres. The lower half of the belt is the pulling half. Where the non-pulling side is permitted to run slack, about, as

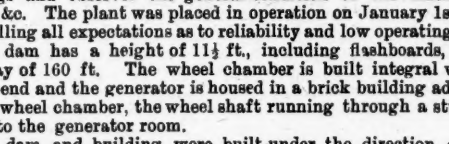


FIG. 1.

shown in fig. 1, the weight of the belt alone, hanging in the form of a catenary, will compensate for the centrifugal force up to a considerable speed in most cases. The weight of the belt alone is enough to pull it down below the tangent line T T, in which case a curve concave upward is formed between the pulleys, inertia causing the sharpest curvature to form close to the small pulley, thus increasing the arc of contact considerably more than when the belt is not in motion, and creating a counter centrifugal force that can be accurately computed as soon as we know the curvature at the sharpest turn. If this "slack curvature" is equal to the curvature of the small pulley we are justified in assuming that the ill effects of centrifugal tension are eliminated.

Sparking Distances in Electrical Installations.—A mass of reliable data is now available concerning sparking distance between electrodes of simple goemetrical form (needle points, disks, spheres, &c.), under various conditions, but little information has hitherto been available concerning sparking distances between metallic conductors and walls in workshops and on switchboards, &c. This problem, which is obviously of great practical importance, was recently investigated by Gino Rebora (See also Atti dell' Associazione Elettrot. Italiana No. 31,913), and the first result deduced was the fact that a grain of dust or a fine hair or fibre would often suffice to start discharge from a high-tension conductor. A point or angularity in a conductor may cause a discharge to occur which would otherwise require 30 per cent. higher pressure than that actually operative; it is therefore very desirable that all metal subject to high-tension current should be as free as possible from points and angularities of any kind. The black lines frequently seen on switchboards and walls behind high-tension conductors reveal the presence of sustained feeble discharges which bombard the surface near the conductor with particles of dust.

From observations made in 30 installations, working at pressures between 3,000 and 110,000 volts, Rebora derives a curve showing the minimum safe distance between conductor and earthed walls or metal covers, &c. As shown by the following data, his limits are rather less stringent than those recommended (but not always observed) by the G.E.C.:—

	P.D.	20	40	60	80	100	Kilovolts.
Minimum distance between conductor and earth	Rebora	100	200	330	450	590	mm.
	G.E.C.	150	300	450	620	770	mm.

As regards the effective height of porcelain insulators of pylon form, used as intermediate insulators on distribution boards, &c., this height increases almost linearly at the rate of 5 or 5½ mm. per KV. for pressures up to 80 KV., and then increases more rapidly, to a total of 580 mm. for 100 KV. and 930 mm. for 130 KV. In deriving these data, Magrini, A.E.G., and Richard Ginori insulators were tested.

In the course of investigations conducted in the Ecole Polytechnique de Milan with a view to determining the laws of discharge between conductor and masonry, &c., copper wires, 2, 4, 5, 6 and 8 mm. in diameter, a bar 3 × 10 mm., and a brass tube 23/22 mm. in external and internal diameter were used. As second electrodes were employed in turn walls of cement, stone, hollow brick, eternite, and metal frameworks. The maximum testing pressure available was 100 KV. at 42 cycles per second. When the conductor under test was pointed straight at the wall, breakdown occurred at 20 per cent.—25 per cent. lower P.D. (for separations of 100 to 250 mm.) than would be required to produce discharge between needle points the same distance apart. This is a result of great practical importance, since live metal parts are frequently so arranged in high tension installations as to produce such reductions in the factor of safety.

In the case of conductors running parallel to walls or bent round in a semicircle at the end abutting the wall, breakdown follows much the same law as that between needle points; this applies also to discharge between conductors and metal frameworks. Using brass tubes about 1 in. in diameter, a higher P.D. was required than with wires to produce breakdown across a given gap.

Data collected from a number of diverse installations concerning the minimum safe height of intermediate insulators and the minimum safe distance between conductors and walls are unexpectedly consistent, and lead to the conclusion that the minimum distance between conductor and earth should correspond to a breakdown pressure 1·8 or 2 × normal line pressure. In a balanced and insulated three-phase system, this rule leads to a factor of safety (= minimum breakdown voltage / actual P.D. between conductors and earth) of 3·0 or 3·5. In conclusion, emphasis may again be laid on the desirability of avoiding sharp points and edges which, if present, facilitate brush discharge and subsequent "heavy current" or "power" breakdown accompanied by extensive damage.

American Station Proof Against Fire.—The electric service of the famous old city of Salem is furnished by the Salem Electric Lighting Co. That the people of Salem are not without central station service to-day is due to a wise engineering foresight which not long ago resulted in carrying out a scheme of plant reconstruction along fireproof lines which splendidly met the test when it came. The fire started in a distant part of the city. Fanned by a strong wind, the blaze carried everything before it, laying more than 1,000 buildings in ruins before its course was finally stayed. Some six hours after the conflagration started, the flames swept down upon the lighting company's station, surrounded it, beat against its brick walls and wire-glass windows with a fury which only those on the spot can appreciate, and then passed on, leaving every other structure in the vicinity a heap of smoking ashes and *débris*. Some damage was done to the coal conveyer, but the five employés who remained in the station during its ordeal of fire kept steam on the boilers and ran an exciter at normal voltage. There was nothing for the main generating units to do, as the outgoing lines in the vicinity of the plant were gone; but during the night following the conflagration street lighting service was resumed through a considerable portion of the city, and commercial lighting and power began to be supplied. Within 48 hours of the start of the fire the company was supplying electricity to nearly everyone in town who was in a position to receive service through temporary mains. The manager of the company and a number of other employés lost their homes, but with dauntless courage every man attacked the problem of restoring the service at the earliest possible moment.—*American Electrical Review.*

Half-Watt Lamps for Lighthouses.—The use of half-watt lamps in lighthouses has proved very satisfactory, as the light emitted by these lamps is very penetrating, and, since the filament is concentrated in a small space, focusing is particularly easy, and therefore the obtaining of a good beam is readily accomplished. A 3,000-C.P. Osram half-watt lamp has been installed in a lighthouse on the end of the Port Talbot Dock and Railway Co.'s pier. A 1,000-watt 1,000-C.P. Osram drawn-wire lamp was first installed, and the pilots were able to pick up the light when off the Mumbles Head, a distance of between 4½ and 5 miles; this lamp was superseded by the 1,500-watt 3,000-C.P. Osram half-watt lamp, and the pilots are now able to pick up the light when much farther down the Channel, the estimated distance being 7 miles.

An Osram half-watt lamp has also been installed on the pier head at Dunoon, without any protection whatever from the weather, and has had to withstand the very severe vibration of the pier head, but no trouble has been experienced.

Fatalities.—BOLSOVER.—At the adjourned inquest on the body of Josiah Hunter, who was found dead in front of an electric coal-cutter at Oxcroft Colliery, Bolsover, on July 7th, Mr. Elliot Smith, representing the Midland Coalowners' Indemnity Association, took exception to a rider being put into the mouths of the jury by Mr. Nelson, H.M. Inspector. Evidence was given showing that the trailing cable insulation was faulty and that it was tested at least once a week. Mr. Nelson considered that a daily test was a necessary precaution, and the Coroner, in recommending a verdict of accidental death, said the jury could add a rider, which Mr. Nelson had suggested should be "that more effective arrangements should be made to test the continuity of the earth conductor." Mr. Elliot Smith contended that any recommendation should come spontaneously from the jury, adding that the suggestion of the Inspector would receive the greatest consideration, and that it was unnecessary to add it as a rider. For the company it was intimated that all such trailing cables had been replaced, and that so soon as apparatus was available, the suggestions made would be carried out.

EALING.—On Friday last, an emery wheel in the Ealing Common Works of the District Railway burst; two employés were seriously injured, one of whom subsequently died.

Lead Poisoning.—The electrolytic treatment of lead poisoning was discussed at the Public Health Congress at Edinburgh University on Saturday last. Dr. William H. F. Oxley, London, said that he had experimented with the electrolytic treatment, and had not been able to confirm the results of Sir Thomas Oliver or that any lead was extracted from the body by means of the treatment. Sir Thomas Oliver said that their experience in Newcastle was extremely favourable to the treatment. As to the extraction of lead from the body, he thought there was no doubt.—*Chemical Trade Journal.*

Denatured Electricity.—An interesting method of preventing the improper use of electric current has been devised by an Italian engineer. The practice of making especially low rates for energy to be used in electric power, heating and cooking devices is becoming more and more general, but with the ordinary constant-pressure supply, it is difficult to prevent the use of lighting devices on circuits intended only for power and heating purposes.

This engineer advocates the use of special circuits on which the current is subject to extreme fluctuation of voltage at rapidly-recurring intervals, which would make it practically impossible to use lamps, because of the flicker in the light. As the current is not entirely interrupted and the normal voltage is almost immediately restored the proper operation of power or heating apparatus is not interfered with, and the rightful use of the circuits for their respective purposes is assured. At the same time, it should be noted that this system would be fatal to the use of luminous radiators.

Mercury-Vapour Light for Inspecting Translucent Products.—Cube sugar and ivory piano keys are inspected under artificial illumination produced by mercury-vapour lamps with greater speed and accuracy than can be attained in ordinary daylight. Raw sugar is a brown substance, while the refined product is pure white, its whiteness being due to the same cause as the whiteness of snow, since both are made up of small transparent crystals. Any impurity in sugar manifests itself by changing the white to a shade of yellow. To detect impurities, plates of the crystallised sugar 1 in. thick are examined by a man looking through them towards a mercury-vapour lamp. When thus viewed, yellow impurities stand out clearly in the bluish-green light. The colour of ivory varies from the outside to the centre of the tusk to such an extent that manufacturers sort the pieces into 16 different shades. Formerly this sorting could be done only in bright daylight, but with the light of the mercury-vapour lamp grading can be done without limitation at any hour out of the entire 24.—*Electrical World.*

An American Visit.—Mr. R. Stuart Pilcher, general manager of the Aberdeen Tramways, who has returned from a visit to the United States and Canada, says in the last 14 years there has been not merely a great change there, but a complete transformation of both the operating conditions and the type of cars which are used to cope with the heavy traffic conditions. The "Pay-As-You-Enter" system worked very smoothly even when the traffic was greatest. Tramway managers will be amused to hear that in one city the leading newspaper devoted one column of the daily paper to "Tramway Breakdowns"—then followed in tabulated form the breakdowns in detail of the previous day, showing the place, time, and length of delay. For the size of the city, which was at present discussing municipalisation, the breakdowns were certainly numerous. The speed on the American systems was much greater than on this side, in spite of the fact that they had very few fixed stopping stations; the permanent way and general road-bed were very bad, so bad that such a condition would not be tolerated by the authorities on this side. The trailer-cars in use in the city of Montreal were exceptionally fine, and seemed to be about the last word in safe operation. The New York surface systems were disappointing, being rather behind the times, and there was a lack of co-operation between the different companies operating—one company would not receive the transfers of another company—and the poor stranger got little assistance from the companies, who had no maps or guides such as one would expect on any large system. His impression, after seeing seven representative systems, was that the street railways were not run with as much regard to public convenience and safety as were the tramways on this side; and, further, the employés did not seem to consider it any part of their duty to be attentive to the passengers.

Cancer Treated by Heat.—At the Clinical Congress of Surgeons of North America, held in London last week, Dr. J. F. Percy read a paper on the treatment of cancer by heat. The apparatus used was a most efficient electric heating iron, which could be perfectly regulated when applied to the involved tissue. With this apparatus and his water-cooled speculum, a maximum penetration and dissemination of heat was obtained. The degree of heat which was necessary did not burn up the cancerous mass, but merely made it so hot that the hand of the surgeon, encased in a medium-weight rubber glove, could not hold it. When this degree of heat was reached and maintained for from 10 to 20 minutes, the cancer cells were absolutely killed, while the normal tissue cells were not injured. The basic idea of this treatment was not cauterisation, but the production and dissemination of heat in the gross primary mass of cancer.—*The Times.*

Army and Navy Service Vacancies.—The War Office has issued notices inviting the services of artificers, coppersmiths, electricians, pattern-makers, and other classes of skilled workmen, as well as of motor-cyclists.

The Royal Naval Volunteer Reserve wants recruits, especially men with a knowledge of Morse signalling and wireless telegraphy, fitters, electricians and metal workers.

Radium.—According to the *Chemical Trade Journal*, the new works of the British Radium Corporation, Ltd., at Elmers End, near Beckenham, are now in operation, and the extraction of radium and uranium by the company's special process, on a much larger scale than at the former works at Limehouse, is now proceeding.

Appointments Vacant.—Plumber-jointer for Singapore Municipality (£23); assistant telegraph engineers for the Gold Coast (£400); laboratory steward for physics and electrical engineering (£65), for Huddersfield Technical College. Particulars are given in our advertisement pages.

Educational Notes.—Royal Technical College, Glasgow.—Session 1914-15 begins on September 23rd. Particulars are given in our advertisement pages.

City and Guilds of London Institute.—The programme for 1914-5 has been issued.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. Geoffrey Porter, who has been associated for some years with Edmundsons' Electricity Corporation, has now been appointed to the post of assistant chief engineer to the British Columbia Electric Railway Co. On Tuesday, July 28th, a number of resident engineers connected with the Edmundsons' supply stations attended a farewell luncheon at which Mr. Porter was the guest. The rendezvous was very appropriately the Brompton and Kensington Restaurant, where the cooking is all carried out electrically. After the luncheon a number of speeches were made congratulating Mr. Porter upon his appointment, and wishing him good luck in his new position. As a memento of the occasion and as a connecting link with the Edmundsons' stations, Mr. Brandreth, of High Wycombe, who was chairman, presented Mr. Porter with a gold albert, on behalf of the engineers. Many, who through holidays or business were unable to be present, sent letters of congratulation and good wishes.

The Wimbledon Corporation is recommended to increase the salary of Mr. W. J. Oswald, an engineer-in-charge at the electricity works, from £156 to £182 per annum.

The Torquay T.C. has increased the salary of Mr. Salt, the electrical engineer, from £350 to £400 per annum at Midsummer this year, and to £450 at Midsummer, 1915, on condition that he undertakes to remain with the T.C. until the works now contemplated are completed.

The York T.C. has decided to increase the salary of Mr. L. A. Thain, charge engineer at the electricity works, from £100 to £110 per annum from October 1st next, with a further increase to £120 on October 1st, 1915.

Mr. Alec Sinclair, son of the chairman, has been appointed charge engineer by the Swansea Electric Lighting and Tramways Committee.

Mr. Edgar F. Kent, of Sunderland, has been appointed to the position of superintendent of the meter and electrical testing department of the Salford electricity works, at a salary of £150, rising to £200 per annum.

Mr. G. C. Milnes, electrical engineer for the Lancaster Corporation, has been called out with the 5th King's Own Royal Lancaster Regiment, of which he is a lieutenant. He left Lancaster with the battalion on Wednesday.

Tramway Officials.—The Brighton T.C. has, on the recommendation of the Tramways Committee, increased the salary of the engineer and manager, Mr. W. Marsh, from £400 to £500 per annum.

General.—Alderman Robinson, for 10 years chairman of the Bradford Electricity Committee, has been asked to accept the Lord Mayoralty of the city for the next corporation year.

The marriage took place at St. Peter's and St. Paul's Church, Wangford, on Saturday last, of Mr. Thomas Arthur Pond, A.M.I.E.E., of Hatcham Park, and Miss A. C. Clatten, of Church House, Wangford.

The Barnsley Education Committee has appointed Mr. C. H. Matthews as instructor in electrical wireman's work, and Mr. J. E. Jackson as instructor in electrical engineering at the Technical School.

At the Whitehall Club on Tuesday, July 28th, some 40 friends and well-wishers of Mr. Mark H. Robinson met, under the chairmanship of Sir Frederick Donaldson, to present him and Mrs. Robinson with a memento of the anniversary of their golden wedding, which they had reached on the previous day. In all some hundred friends had subscribed towards the memento, which was presented in conjunction with an album containing their signatures. The movement was organised by a Committee consisting of Captain Sankey, Mr. J. C. Peache, Mr. G. F. Clayton East, Mr. P. A. Low and Mr. E. J. Fox, the last of whom acted as honorary secretary.

Obituary.—We regret to record the death of Mr. J. Eaton Shore, shops superintendent at Messrs. Siemens Bros. Dynamo Works, Stafford, who passed away on July 23rd. According to the *Staffordshire Advertiser*, Mr. Eaton-Shore had been with Messrs. Siemens since 1908, and previously served with Messrs. Willans & Robinson for 22 years.

The death is announced of ex-Provost Brownlee, of Dundee. It was largely through his efforts that the Corporation electrical undertaking was started and the tramway system electrified and municipalised.

NEW COMPANIES REGISTERED.

Loughrea Electric Power and Lighting Co., Ltd. (4,178).—This company was registered in Dublin on July 24th, with a capital of £2,500 in £1 shares, to carry on the business indicated by the title. The subscribers are:—F. A. Sweeny, Loughrea, Co. Galway, merchant, 50 shares; A. D. Comyn, Loughrea, Co. Galway, solicitor, 50 shares; Wm. J. Duffy, Loughrea, Co. Galway, M.P., 40 shares; Ed. O. Dea, Loughrea, Co. Galway, hotel proprietor, 50 shares; P. K. Kennedy, Loughrea, Co. Galway, victualler, 30 shares; J. Staunton, Loughrea, Co. Galway, draper, 50 shares; J. Geraghty, Loughrea, Co. Galway, medical doctor, 50 shares; C. S. Graham, Loughrea, Co. Galway, solicitor, 50 shares; D. Crowley, Loughrea, Co. Galway, medical doctor, 40 shares. Private company. The directors are A. D. Comyn, J. Geraghty, P. Kennedy, F. A. Sweeny, D. Crowley, C. S. Graham, J. Staunton, E. O'Dea and W. J. Duffy; qualification, 30 shares. Registered office, Loughrea, Co. Galway.

International Bleachers' Corporation (1914), Ltd. (137,234).—Registered July 28th by P. G. G. Shaw, 4, Clement's Inn, Strand, W.C. Capital, £120,000 in £1 shares. Objects: To take over the undertaking and all or any of the assets and liabilities of the International Bleachers' Corporation, Ltd. (incorporated in 1913), and to carry on the same and business of mechanical and electrical engineers, manufacturers of and dealers in all apparatus and things required for or capable of being used in connection with electric, electrolytic or chemical bleaching or like appliances and apparatus, &c., and to enter into an agreement with the said old company. Purchase consideration, £98,673 15s., payable as to £988 15s. in cash and £97,685 in shares. The signatories (with one share each) are:—P. G. G. Shaw, 4, Clement's Inn, W.C., solicitor; W. T. Pollard, 4, Clement's Inn, W.C., clerk; H. Hackett, 44, Bedford Row, W.C., chartered accountant; R. Andrews, 169, Southampton Street, Camberwell, S.E., clerk; A. G. Emblow, 24 Lymington Road, West Hampstead, clerk; R. C. Miller, Seeburg Park Avenue, Hulton, clerk; M. Daborn, 18, Freshford Street, Earlsfield, S.W., clerk. Minimum cash subscription, seven shares. The first directors (to number not less than two or more than seven) are A. Fraser, Offley, near Hitchin; A. T. Masterman, 46, Gillingham Street, Eccleston Square, S.W.; J. L. Kerpen, Hyde Park Hotel, Knightsbridge, S.W.; E. Chapman, 4, Bedford Chambers, Covent Garden, W.C.; O. Sumner, 4, Bedford Chambers, Covent Garden, W.C.; and Col. W. M. Hodder, Holdene, near Cobham. The directors, with the exception of Col. W. M. Hodder, are directors of the vendor company, and they are all shareholders therein; A. Fraser, holding 150 ordinary and 300 founders'; A. T. Masterman, 400 ordinary and 700 founders'; J. L. Kerpen, 101 ordinary and 210 founders'; E. Chapman, 1,605 founders'; O. Sumner, 100 founders'; Col. W. M. Hodder, 400 ordinary and 297 founders'; qualification, 100 shares; remuneration not less than £50 each per annum and 2½ per cent. each of the surplus profits set aside for distribution as dividend in each year. Registered office, 4, Bedford Chambers, Covent Garden, W.C.

"Dac" Accumulator Syndicate, Ltd. (137,206).—This company was registered on July 27th, with capital of £1,000 in £1 shares, to adopt an agreement with the "Dac" Accumulator Syndicate, Ltd., and H. C. Bound, the liquidator thereof, for the acquisition of certain patents and other property, to carry on the business of electrical engineers and contractors, manufacturers of cells and batteries, suppliers of electricity, &c. The subscribers (with one share each) are:—J. S. Parker, 128, Holborn, E.C., merchant; S. W. Simpson, 72, Janson Road, Stratford, E., clerk; B. McKinna, 88, Guilford Street, W.C., clerk; J. C. Eastaugh, 39, Holmwood Road, Seven Kings, clerk; W. T. Letts, 61, Cartwright Gardens, Russell Square, W.C., clerk; A. F. Newberry, Stafford House, Broxbourne, stockbroker; H. E. Hughes, 90, Goswell Road, E.C., merchant. Minimum cash subscription, seven shares. The number of directors is not to be less than two or more than seven; the first are J. S. Parker, A. F. Newbery, and H. E. Hughes; remuneration for first year, £50 per annum (subsequent years, £100 each per annum, chairman £25 extra), and a percentage of the profits. Registered office, Cheshunt Wharf, Cheshunt, Herts.

Chemico-Electric Co., Ltd. (137,349).—Registered July 29th, by Loughborough, Gedge & Co., 23, Austin Friars, E.C. Capital, £85,000 in 50,000 preference shares of £1 each and 140,000 ordinary shares of 5s. each. Objects: To carry on the business of miners, quarrymen, manufacturers of chemicals and products, engineers, chemists, manufacturers of nitric acid, cyanide, paraffin wax, lubricating oils, petrol and by-products of coal, storekeepers, shippers, charterers of ships and other vessels. To deal with shares and other securities of any company formed for the purpose of carrying on or developing the business of chemicals and manufacture of chemical products of all kinds and the development and supply of power in the form of gas, electricity or otherwise. The signatories (with one preference share each) are:—Sir William H. Marling, Bt., Stanley Park, Stroud, Glos.; F. Winterbotham, Stroud, Glos., solicitor; W. E. J. Hallett, Green Hook, Selsley, Glos., gentleman; O. D. Lucas, 39, Victoria Street, S.W., engineer; W. A. Harper, 3, Deanery Street, Park Lane, W., engineer; J. A. Millington, 30, Upper Montagu Street, E.C., civil engineer; H. R. Hogg, 23, Hornton Street, Kensington, W., merchant. Private company. The first directors (to number not less than two or more than ten), are to be appointed by the signatories; qualification, £100; remuneration as fixed by the company. Registered office, 13, St. Helen's Place, E.C.

Harry Tattersall, Ltd. (137,279).—This company was registered on July 30th, with a capital of £3,000 in £10 shares (100 preference), to take over the business of a plumber and glazier, carried on by H. Tattersall at Spotland Bridge, Rochdale, and to carry on the same and the business of incandescent dealers, electric bell and telephone fitters, gas, ventilating and general engineers, &c. The subscribers (with one share each) are:—Hy. Tattersall, 272, Spotland Bridge, Rochdale, plumber and glazier; G. W. McIndoe, 312, Edenfield Road, Passmonds, Rochdale, company secretary. Private company. Table "A" mainly applies. Registered office, Spotland Bridge, Rochdale.

Electromobile (Leeds), Ltd. (137,251).—This company was registered on July 29th, with a capital of £1,000 in £1 shares, to carry on the business of electrical and general engineers, manufacturers of, and dealers in, motor and electric machinery, &c., in Leeds and elsewhere. The subscribers (with 50 shares each) are:—W. Popplewell, Avondale, Stanks, Leeds, grocer; J. A. Popplewell, Graveley, Thorpe, Halton, near Leeds, grocer; F. E. Popplewell, Avondale, Stanks, Leeds, electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are W. Popplewell, J. A. Popplewell and F. E. Popplewell; qualification, £50; remuneration of chairman, £5 per annum: of other directors, £1 per annum. Registered office, 30, Bath Road, Holbeck, Leeds.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Ackroyd & Best, Ltd.—Issue on June 29th, 1914, of £7,050 "A" debentures, part of a series of which particulars have already been filed.

Naylorgraph, Ltd.—Debenture dated July 17th, 1914, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Subject to prior debentures. Holder: J. M. Hunt, Fairlawn, Park Road, Southborough, Kent.

Dudley, Stourbridge and District Electric Traction Co., Ltd. (14,763).—Capital, £200,000 in £5 shares (20,000 ord. and 20,000 pref.); return dated May 25th, 1914; all shares taken up; £200,000 paid. Mortgages and charges: £100,000.

British Thomson-Houston Co., Ltd. (47,982).—Capital*, £800,000 in 40,000 ord. and 40,000 pref. shares of £10 each; return dated June 4th, 1914; all shares taken up; £10 per share called up on 32,631 ord. and 40,000 pref.; £725,310 paid; £74,690 considered as paid on 7,469 ord. Mortgages and charges: £226 215. *Original capital, £240,000 in £10 shares. Increased to £400,000 in 1898, and to present amount in 1902.

Helsby Wireless Telegraph Co., Ltd.—Assignment dated July 9th, 1914, to secure £825, charged on certain moneys receivable from L.N.W.R. for wireless equipment on three ships. Holders: Automatic Telephone Manufacturing Co., Ltd., Milton Road, Edge Lane, Liverpool.

Spensers, Ltd.—Issue on July 17th, 1914, of £500 debs., part of a series of which particulars have already been filed.

CITY NOTES.

Kalgoorlie Electric Tramways, Ltd.

The report of the directors, for the year to 31st December, 1913, shows gross receipts amounting to £34,643 against £37,917 for the previous year, while the net profits earned were £9,549 against £10,099. The directors regret that the depressed condition of affairs at Kalgoorlie, which has prevailed for the past few years, continues to have a serious effect on the traffic receipts. A new and adverse feature has been the keen competition from motor cars owned by private individuals, which can be brought out and operated at only the busiest periods of the day and on special occasions. Although the gross earnings have fallen over £3,000, the net receipts are only some £500 less than last year. This has been brought about by a rigid reduction in unprofitable car mileage and in expenses wherever possible. Reference was made in the last report to the action by the company's employés then before the arbitration courts for improved wages and conditions. The additional wages obtained by the men as a result of this action amounted to some £600 per annum; this extra expenditure has been almost balanced by reductions in staff, and the directors are glad to say that the relations between the company and its men are in every way satisfactory.

The engineer reports that during the year the cars travelled 568,500 car miles, as against 619,170 car miles in the year 1912, and carried 2,266,361 passengers, as against 2,489,833 in the year 1912. The earnings per car mile in 1913 were 14.57d., as against 14.65d. in 1912, with an expense of 9.91d. per car mile, as against 10.27d. in 1912. The expenses per cent. of earnings in 1913 were 67.99, as against 70.08 in 1912. The number of units consumed in 1913 was 610,370, as against 697,015 in 1912.

The "A" debenture stock has been further reduced by a sum of £6,598 in respect of the year under review, and during the current year an additional sum of £6,980 has also been bought for redemption. This has reduced the stock outstanding to the date of this report to £49,800, thus materially improving the position of the "B" debenture stock, although it has not been possible to resume the payment of the interest on the "B" stock.

The tenth ordinary general meeting of the shareholders of this company was held on Thursday last week at the offices of the London Chamber of Commerce, Cannon Street, Mr. Allen H. P. Stoneham, the Chairman, presiding.

In proposing the adoption of the above report, the Chairman said that unfortunately the accounts were not as satisfactory as they could have wished. With regard to the tramways, they had run about 3,000 less car miles and had carried some 200,000 less passengers. The reason for the reduction in the car mileage was that they had cut off some of the unprofitable mileage which they had been running in the past, and that had helped them to keep down expenditure. It was satisfactory to note that although the gross receipts had fallen off by £3,000, the net receipts were only about £500 below those of the previous year. Their hearty thanks were due to Mr. Stanley (their manager in Australia) for the extraordinary efforts he had made to reduce the expenditure. By reason of arbitration awards they were compelled to pay their men about £600 a year increased wages, but, notwithstanding that, the net receipts, as he had before pointed out, were only down £500. The great trouble they had had to deal with was the very unfair competition which the local councils had thought proper to allow to be brought against them by the owners of private motor cars. The company had to pay 3 per cent. of their gross takings to the councils; they had to keep their track in order, and they found that the councils allowed their roads to get into such a bad state that practically the whole of the traffic used the tramway track. In spite of all that, the Boulder and Kalgoorlie Councils had allowed these privately owned motor cars to compete against them. He was sorry to say that although they had appealed to the councils on the subject, they had not been able to get any redress. To an extent it was satisfactory that they were able to earn sufficient profit to pay interest on the debenture stock and to keep up the sinking fund. They had reduced the debentures to less than £50,000, and if they kept on at the present rate in about seven years' time they would have paid off the whole of the "A" debentures.

Mr. O. Wethered seconded the motion.

Replying to shareholders, the Chairman said that the amount to be set aside annually for interest and sinking fund was a fixed sum of £9,000. Of course, as years went on the amount payable for interest would decrease, and by so much would they be able to increase the amount paid off the sinking fund. With regard to the company itself running a motor 'bus service, he was convinced it would never pay. As to whether there was any prospect of the Government buying the company, he could only say that there had been plenty of suggestions to that end, but at the present time there was no probability of anything being done. They found that the Australian Government wanted to buy something when it was very prosperous and when they could get it cheap, but when it was not prosperous, they were not anxious to buy.

The report was adopted.

Yorkshire Electric Power Co.

The directors report that during the past six months there has been an increase in the revenue from the sale of electricity. The net profits (after payment of mortgage interest) for the three corresponding half-yearly periods are:—To 30th June, 1914, £10,414; to 30th June, 1913, £6,972; to 30th June, 1912, £3,349. Including the sum of £4,188 brought from 1913 there is a balance of £14,602, from which has to be set aside £2,250 to provide for the bonus on the repayment of the second mortgages (£45,000), leaving £12,352 to deal with. The directors consider that the balance available justifies a distribution to the ordinary shareholders, and they have decided to declare an interim dividend for the half-year ending 30th June, 1914, at the rate of 2 per cent. per annum, which with the preference dividend at the rate of 6 per cent. per annum will absorb £6,944, and leave £5,408 to carry forward. The "Yorkshire Electric Power Act, 1914," which was approved by the shareholders on February 17th, 1914, now awaits the Royal Assent. This Act renders unnecessary the holding of the usual meeting in September, and authorises the directors to declare an interim dividend, which they have now done. The company has now completed arrangements for the supply of electricity in the eastern portion of its area, and since the 9th July has been giving a supply in Goole for railway, dock and general purposes in addition to a supply to the Goole undertaking of the Distribution Co. The second turbine (3,000 kw.) in the waste heat station at Barugh has been put on load and is a valuable addition to the company's generating plant. Mains are being laid for supply to power users, and to the Distribution Co., in Ardsley, Wombwell and Worsborough, and an agreement has been entered into with that company for supply in Birstall, Greetland and Rothwell, where the company's mains are already laid. Applications have been made by holders of second mortgages for £35,405 of the issue of preference shares in exchange for their holdings and the bonus payable thereon, and in addition £19,265 of these shares have been applied for, making a total of £54,670 taken up since the beginning of the year. The total issues of preference capital authorised amount to £200,000 of which £184,575 has now been taken up, and the directors anticipate that the remaining £15,425 will soon be absorbed.

Swiss Brown-Boveri Co.—The report for 1913-14 of the A.G. Brown-Boveri Co., of Baden, states that, despite the slackening in the general situation of trade during the past year, the electrical industry remained well employed on the whole, although indications of a weakening were manifested by the prevalence of quieter conditions, but these did not lead to a scarcity of work. Under these circumstances, it was possible for the general extension of business to proceed, and the turnover in all departments experienced an increase, which amounted to 20 per cent. on a value of £1,240,000 for the Swiss works alone. The works at Munchenstein, which were acquired from another company, were conducted as the company's branch for the first time in the past year. Particulars are contained in the report of the working results of the concern in which the company is financially interested. These include the Brown-Boveri Co., of Mannheim, the Isaria Meter Works, of Munich, the Insulation Co., of Mannheim-Neckarau, and the Austrian Brown-Boveri Works, whilst the Rhenish Wire and Cable Works has been formed, and has acquired the new factory of J. Wahlen, of Cologne, for the manufacture of insulated wires, a new cable factory being there on the point of being brought into operation. The gross profits earned in 1913-14 amounted to £475,000, as compared with £379,000 in 1912-13, and £383,000 and £298,000 of these totals were realised from manufacturing in the two years respectively, the balance being profits on investments. After meeting general expenses and writing off £104,000 for depreciation, as compared with £60,000 in the previous year, the accounts indicate net profits of £163,000, as compared with £109,000 in 1912-13. It is proposed to pay a dividend of 9 per cent. on share capital of £1,120,000 out of total share capital of £1,280,000, this comparing with 8 per cent. on the former capital in the previous year.

Continental.—Norway.—The Norske Aktieselskab for Elektrokemisk Industry, which is a kind of banking and promoting company for the development of the electrochemical industry in Norway, has invited the public to subscribe a series of 5 per cent. bonds for a total amount of nearly £300,000. The larger portion of the bonds had already been subscribed by various banks before the prospectus was published. The company increased its capital twice during the last half of 1913, and the capital now is £400,000 fully paid. The dividend for 1913 was 8 per cent. Including the new issue the total amount of the funds at disposal will be nearly £700,000. As security for the new issue the company has given a mortgage on the properties of the Arendals Fossekompani and the A/S Björlvefas, which have been valued at £630,000.

Charing Cross, West End and City Electricity Supply Co., Ltd.—The directors have declared an interim dividend on the ordinary shares of the West End undertakings for the half-year ended June 30th, 1914, at the rate of 5 per cent. per annum. Warrants will be posted on August 15th. An interim dividend of 5 per cent. on the ordinary shares of the West End undertakings for the past half-year has been declared.

National Boiler and General Insurance Co., Ltd.—The directors propose to pay a dividend at the rate of 11s. per share, free of tax, for the half-year to June 30th last; bonus of 3s. per share; to add to current risk and reserve fund, £8,000; forward, £6,964. It is also proposed to alter the date of the termination of the financial year from June 30th to December 31st, and to change the date of the annual meeting from August to February.

United Alkali Co.—The directors state that, in the interests of the company, it is inadvisable to declare the usual interim preference share dividend at the present time. The result of the company's operations during the six months to June 30th last has been by no means unsatisfactory, the preference dividend for the half-year having been practically earned.

Kensington and Knightsbridge Electric Lighting Co., Ltd.—The directors have declared an interim dividend on the ordinary shares for the half-year ending June 30th last at the rate of 8 per cent. per annum.

Oldham, Ashton and Hyde Electric Tramway, Ltd.—The directors have declared an interim dividend at the rate of 5 per cent. per annum, less income-tax, on the ordinary shares for the half-year to June 30th.

Brush Electrical Engineering Co., Ltd., and reduced.—A petition for the confirmation of the reduction of capital from £489,512 to £253,780 has been presented, and will be heard on October 16th.

City of London Electric Lighting Co., Ltd.—The directors have declared a dividend of 6s. per share, less tax, for the year ended December 31st last, this being the same rate as a year ago.

Bank Rate.—Since our last issue appeared the Bank Rate has been raised to 8 and 10 per cent.; yesterday, however, it was reduced to 6 per cent.

STOCKS AND SHARES.

Tuesday Evening.

The Stock Exchange was closed last Friday morning—for the first time in its history—for fear of the consequences that would arise out of the European war. For several days previously, the House had ceased to be a market in the true sense of the word. What buying and selling went on was by the process of negotiation only; and on Tuesday in this week Stock Exchange business had come to a complete full stop.

It has been a matter of some debate whether, in the circumstances, the Electrical Review should publish its usual price lists of stocks and shares. The quotations themselves are nominal. It is impossible to deal, either at the figures given or even upon the basis of them. So many brokers, members of the Stock Exchange, have orders in hand to buy for their clients, however, that it was decided to print the lists as usual. Those readers who are fortunate enough to be amongst the bargain-hunters will no doubt scan prices with more than ordinary attention, because there is nothing to prevent brokers from accepting orders which they may be able to execute with their fellow-members, at values probably more tempting to the buyer than to the seller.

For instance, it may be quite possible to pick up a bond, quoted in our lists in the neighbourhood of 90, at ten points or so below this nominal valuation. We do not say that this is the case, but the probability of it is at least inherent. For there are many anxious sellers about; while, on the other hand, during the past few days we have met quite a number of brokers whose clients want to buy exceptionally cheap stock if it is to be secured, and, moreover, to pay for their purchases on the spot, in notes or bank drafts.

To attempt indications of the direction in which bargains should be sought is, for the time being, outside the scope of these notes; but those who follow the prices carefully from week to week will be able to fix some figure at which they regard certain securities as thorough bargains, and if they are prepared to take the risks incidental to Stock Exchange securities in time of war, they need have no hesitation in endeavouring to carry out their wishes through the medium of the Stock Exchange.

Some small proportion of the prices in the lists over-leaf were altered before the House was closed and before business came to a conclusion, so far as an actual market was concerned. Certain sections round the House, however, declined to vary the previous nominal quotations of the preceding week, contending that, as there were no real prices, to mark down figures in the Stock Exchange Official List was superfluous, and that lowered prices would be equally as misleading as those then standing.

To what extent commercial undertakings will be affected by the hostilities, it is, of course, impossible to say. In every direction the ordinary spending of the public will be materially curtailed, and this can hardly fail of its effect upon industrial profits. But such an influence must be ruled largely by the period of time over which the war extends; and as all the electric supply companies, for example, are doing well, their interim dividend statements showing this, it is conceivable that the net result may not reach any magnitude of loss. As to this, however, everything is mere guess-work. One of the halfpenny evening papers, by the way, in its excitement of last week, announced the failure of three members of the Stock Exchange who had not been hammered; while, on the same day, it paid the Metropolitan District Railway the barren compliment of quoting its Ordinary stock *ex* dividend!

Such firms as Babcock & Wilcox, Armstrongs, Vickers and other such engaged in kindred businesses are likely to gain substantially, while some of the engineering and stamping companies had peremptory orders last week-end to hasten all Admiralty work. In one case that came under our notice, a certain small company was instructed to rush forward at all speed some work required in connection with the Navy, and with the instructions came a notification that there would be no inspection before delivery.

The cable companies in times of past wars have derived mixed benefits. A boom in the number of messages may be counteracted by damage done to lines, to stations, and so on. At the present time the absence of all Stock Exchange business is a serious consideration to the Anglo-American concerns, but there is war traffic to help in filling the gap. How the Marconi Company is likely to fare is a matter for conjecture; after the war when peace breaks out, the orders will probably pour in if the system should have been demonstrated as invaluable in times of strife as in those of peace. But there is also possible competition to be considered.

In the matter of gilt-edged securities, examples of which are so numerous in our price lists, the lowering of credit caused by the sudden national demand for cash, and by the abnormal Bank Rate, tends naturally to reduce prices, because if people can get sound Government stocks to yield 5 per cent., they are not going to buy industrial debentures which return 4 to 4½ per cent. This, however, is another problem set for prophecy, and its reply must depend upon the answer to the patriotic prayer that it may not be long before the British Navy and our allies give such an account of themselves as will leave their enemies nursing very sore heads for half a century or two.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	Inc.
		£	£		£	£		
Bath	July 29	5,177	+ 256	29	29,256	+ 2,162	..	..
Blackpool-Fleetw'd	,, 25	5,283	— 31	29	19,888	+ 514	8	..
Bristol	,, 31	39,779	+2,903	31	259,743	+20,392	80·5	..
Brit. Elec. Trac. Co.	,, 24	247,536	+3',076	..	..	..	429·8	..
Chatham and Dist.	,, 23	4,331	+ 177	29	26,660	+ 536	14·98	..
Cork	,, 30	1,946	+ 127	30	17,317	+ 745	9·89	..
Dublin	,, 24	27,583	+ 756	30	171,404	— 2,667	54·25	..
Hastings	,, 22	4,895	+ 267	29	..	+ 572	19·3	..
Lancashire United	,, 29	6,776	+ 219	30	49,731	+ 5,001	42	..
Llandudno-Col. Bay	,, 24	2,207	— 56	84	9,124	..	6·5	..
London United ..	,, 24	28,405	— 185	30	184,589	+ 2,412	..	..
Tyneside	,, 21	1,838	+ 79	4	1,838	+ 79	11	..
Anglo-Argentine ..	,, 29	111,114	—7,868	30	1,668,853	— 1,910	..	..
Auckland	,, 5	20,919	+ 912	48	247,311	+ 6,331	25 42	1·03
Calcutta	,, 25	18,614	+1,130	..	..	+ 7,615	..	..
Kalgoorlie, W.A. ..	June	2,692	..	26	15,522	..	20·5	..
Madras	June 15	3,718	+ 2·5	23	21,199	+ 1,691	15·25	..
Montevideo ..	July	26,417	- 2,772	31	285,663	— 8,939	..	..
Cen. London Rly.	July 25	18,403	+ 294	30	148,856	— 2,496	6·78	·4
City & S. Lon. Rly.	,, 25	9,871	— 876	30	2,425	— 223	7·26	..
Dublin-Lucan Rly.	,, 31	771	— 62	4½	773	— 59	7	..
L'pool Overh'd Rly.	,, 26	6,938	— 988	30	51,398	— 523	6·6	..
London Elec. Ry. Co.	,, 25	51,225	—1,060	30	420,515	+ 1,440	21·25	..
Mersey Railway ..	,, 25	8,466	— 574	30	66,956	— 298	4·5	3·5
Metropolitan Rly.	Aug. 2	75,082	+ 856	31	668,081	+42,280	29·25	..
Met. District Rly.	July 25	51,574	— 394	30	393,909	+ 190	25	..

Market Quotations.—Owing to the markets being closed on account of the outbreak of war, we are informed that no official quotations can be given. Our last statement appeared on July 24th; the prices must be regarded as at present purely nominal.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Aug. 4th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..		..	Nil
Do. 5 % Pref.	1	5	5		..	6 19 0
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	16½ — 18½	..	..
Do. Do. Deferred	100	..	..	10 — 12	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	85 — 89	..	6 11 2
Do. 7 % Non-Cum. Pr'f.	100	8	8½	84 — 87	..	6 2 10
Do. 5 % Perp. Deb.	100	5	5	91 — 93	..	5 7 5
Do. 4½ % 2nd Deb.	100	4½	4½	75 — 78	..	5 15 5
Central London Railway, Ord.	100	3	3	55 — 60 xd	..	5 0 0
Do. Gtd. Assented	100	..	4	80 — 82	—2	4 17 7
Do. Pref.	100	4	4	66 — 71 xd	..	5 12 7
Do. Gtd. Assented	100	..	4	84 — 86	..	4 18 0
Do. Def.	100	2	2	40 — 45	..	4 9 0
Do. Gtd. Assented	100	..	4	79 — 81	—1	4 18 7
Do. 4 % Deb.	100	4	4	95 — 97	..	4 2 6
City & S. London, 5 % Pref., 1891	100	5	5	92 — 95 xd	..	5 5 0
Do. Do. 1896	100	5	5	88 — 91 xd	..	5 10 0
Do. Do. 1901	100	5	5	86 — 89 xd	— ½	5 12 4
Do. Do. 1908	100	5	5	86 — 89 xd	— ½	5 12 4
Do. 4 % Deb.	100	4	4	86 — 88	..	4 11 0
Hastings Trams, 6 % Pref.	1	6	6†	4⅞ — 5⅛	..	8 6 8
Do. 4½ % Deb.	100	4½	4½	65 — 70	..	6 8 7
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	71 — 76	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	84½ — 86½	..	5 15 4
London and Suburban, Ord.	1	..	1	⅛ — ⅜	..	3 10 10
Do. Do. 5 % Cum. Pref.	1	..	5†	⅜ — ⅝	..	8 0 0
Do. Do. 4½ % 1st Deb.	100	4½	4½	73 — 78	..	5 15 5

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Aug. 4th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
London Elec. Railways, 4 % Deb.	100	4	4	87 — 90	..	4 9 0
London United Trams, 4 % Deb.	100	4	4	53 — 57	..	7 0 4
Metropolitan Railway Consol.	100	1⅝	1⅝	31¼ — 31½ xd	—2½	5 2 4
Do. Surplus Lands	100	2⅜	2⅜	58 — 60 xd	— ⅛	4 11 9
Do. 3½ % Deb.	100	3½	3½	85 — 87	..	4 0 6
Do. 3½ % Pref.	100	3½	3½	70 — 82 xd	..	4 5 4
Do. 3½ % Con. Pref.	100	3½	3½	72 — 79 xd	..	4 8 7
Metropolitan District Ord.	100	Nil	..	18¾ — 19½	—1½	Nil
Do. 6 % Deb.	100	6	6	184 —188	—1½	4 7 0
Do. 4 % Deb.	100	4	4	90 — 93	..	4 6 0
Do. 4 % Prior Lien	100	4	4	94 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	78 — 80 xd	—2½	5 12 6
Do. 3½ % Gtd.	100	3½	3½	72 — 74 xd	..	4 14 7
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
Do. 5 % Deb.	100	5	5	85¼ — 88½	..	5 13 0
Potteries, Ord.	1	3½	3½	3⅞ — 4⅛	..	8 12 10
Do. 5 % Pref.	1	5	5	3⅞ — 4⅛	..	7 12 8
Do. 4½ % Deb.	100	4½	4½	81½ — 84½	..	5 6 2
South Metro. Trams, 4 % Deb.	100	4	4	64 — 68	..	5 17 8
Underground Elec. Railways	10	..	..	2 — 2⅛	— ⅛	Nil
Do. "A"	1/-	..	..	3/32 — 1/8	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	112 —114	—1	5 5 4
Do. 4½ % Bonds	100	4½	4½	97 — 99	—1	4 11 0
Do. 6 % Income	100	6	6	82 — 84	—4½	7 2 10
Yorkshire (West Riding), Ord.	5	Nil	Nil	⅛ — ¼	..	Nil
Do. 6 % Pref.	5	3	4	4½ — 4⅝	..	4 6 6
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 4 8

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4⅛ — 4⅜	..	5 17 4
Do. 2nd Pref.	5	5½	5½	4⅛ — 4⅜	..	6 5 9
Do. 4 % Deb.	100	4	4	90 — 92	..	4 7 0
Do. 4½ % Deb.	100	4½	4½	57 —100 xd	..	4 10 0
Do. 5 % Deb.	100	5	5	95 — 97	..	5 3 0
Auckland Trams, 5 % Deb.	100	5	5	101 —104	..	4 16 3
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅜ — 11½ xd	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	95 — 97	..	4 12 9
Do. 5 % 2nd Deb.	100	5	5	99 —101	..	4 19 0
Brazilian Traction, Light and Power	$100	6	6†	56 — £0 xd	—1½	10 0 0
Brisbane Trams Invt., Ord.	5	8	8	7¼ — 7⅝	..	5 8 3
Do. 5 % Pref.	5	5	5	4⅜ — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5
B. Columbia Elec. Rly., Def.	100	8	8†	104 —108	..	7 8 2
Do. Pref. Ord.	100	6	6	100 —104 xd	..	5 15 5
Do. 5 % Pref.	100	5	5	101 —104	..	4 16 2
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 —101	..	4 9 0
Do. 4½ % Vancouver Deb.	100	4½	4½	92 — 96	..	4 13 9
Do. 4½ % Con. Deb.	100	4½	4½	95 — 97	..	4 7 9
Calcutta Trams, Ord.	5	7½	9½	7 — 7½	..	6 6 9
Do. 5 % Pref.	5	5	5	4⅛ — 5⅛	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	98 —101	..	4 9 0
Cape Electric Trams	1	5	5	⅞ — 1	..	6 18 4
City Buenos Aires Trams (1904)	5	5	5	5⅜ — 5⅝	..	4 9 0
Do. 4 % Deb.	100	4	4	95 —100	..	4 0 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 97	..	5 3 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	91 — 96	..	5 5 3
Kalgoorlie El. Trams 5% A Deb.	100	5	5	89 — 87	..	5 15 0
Do. 6% B Deb.	100	3	..	10 — 20	..	Nil

La Plata Elec. Trams, Ord.	1	..	..	⅛ — ¼	..	..
Do. Pref.	1	4½d.	6	3⅜ — 3⅝	..	6 5 0
Lisbon Elec. Trams, Ord.	1	6	6	1⅝ — 1¾	..	4 9 3
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	4 16 0
Do. 5 % Deb.	100	5	5	92½ — 97½	..	5 2 6
Madras Elec. Tr., 6% Cum. Pref.	5	6	6	4⅛ — 5⅛	..	5 14 3
" Elec. Tr. (1904), Deb.	100	5	5	99 —101	..	4 19 0
Manaos Trams & Lt., 1st Deb.	100	5	5	75½ — 78½	..	6 7 5
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100 —102	..	4 18 0
Mexico Trams Com	$100	7	7	60 — £5	—2½	..
Do. Gen. Con. 5 % Bonds	..	5	5	£2 — 86	..	5 16 8
Do. 6 % Bonds	100	6	6	74 — 78	..	7 13 10
Para Elec. Rlys. & Lt., Ord.	5	10	10	4 — 4½	..	11 2 2
Do. 6 % Pref.	5	6	6	4 — 4½	..	6 13 4
Do. 5 % 1st Deb.	100	5	5	£8 — 91	..	5 10
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	94 — 96	..	4 13 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	96 — 98	..	5 1 0
Do. 5 % Mort. Bonds	100	5	5	88½ — 90½	..	5 10 6
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	97 —101	..	4 19 0
Singapore Trams, 5 % Deb.	100	5	5	88 — 92	..	5 8 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	90 —102	..	4 18 0
Un. Elec. Trams Monte Video	5	7	7	4½ — 4⅝	..	7 7 4
Do. 6 % Pref.	5	6	6	4⅝ — 5⅛	..	5 17 8
Do. 5 % 1st Deb.	100	5	5	95 — 97	..	5 3 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	93½ — 95½	..	4 14 8

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

Bournemouth & Poole, Ord.	10	6	7	10 — 11	..	6 7 4
Do. 4½ % Pref.	10	4½	4½	9½ — 10½	..	4 5 9
Do. Second 6 % Pref.	10	6	6	10½ — 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	93 — 96	..	4 13 9
Brompton & Kensington, Ord.	5	10	10	8⅞ — 9⅜	..	5 6 8
Do. 7 % Cum. Pref.	5	7	7	8⅜ — 8⅞	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	91 — 94	..	4 5 1
Charing Cross, West End & City	5	5	6	5 — 5⅛	..	5 11 7
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 5	..	4 10 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4½	..	5 0 0
Do. Do. 4 % Deb.	100	4	4	90¼ — 92½	..	4 6 6
Chelsea, Ord.	5	5	5	4⅝ — 5⅛	..	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	95 — 98	..	4 11 0
City of London, Ord.	10	9	10	15½ — 16½	..	6 1 4
Do. 6 % Cum. Pref.	10	6	6	13 — 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	115 —118	..	4 4 9
Do. 4½ % Second Deb.	100	4½	4½	99 —102	..	4 8 1
County of London, Ord.	10	6	7	11⅜ — 12½	..	5 14 3
Do. 6 % Pref.	10	6	6	11⅜ — 12½	..	4 18 0
Do. 4½ % Deb.	Stock	4½	4½	101 —104	..	4 6 7
Do. 4½ % Second Deb.	Stock	4½	4½	99 —102	..	4 8 1
Edmundson's, Ord.	£3	..	..	⅝ — ¾	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3¾ — 4	..	7 10 0
Do. 6 % Non-Cum. Pref.	5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	86 — £5	..	5 6 0
Folkestone	5	6	6	5 — 5¼	..	5 9 1
Do. 4½ % First Deb.	100	4½	4½	91 — 95 xd	..	4 16 9

Hove	5	8	9	8¼ — 9	..	5 0 0
Kensington & Knightsbridge, Ord.	5	8	9	7½ — 7⅝	..	5 16 3
Do. 4 % Deb.	Stock	4	4	90 — 92 xd	+1	4 7 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	74 — 78	..	5 15 0
London Electric, Ord.	3	2⅜	3	1⅜ — 1⅝	..	5 10 0
Do. 6 % Pref.	5	6	6	4⅜ — 5⅛	..	5 14 3
Do. 4 % First Mort. Deb.	Stock	4	4	91 — 94	..	4 5 1
Metropolitan	5	4½	4½	8⅜ — 8⅝	..	6 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝ — 4⅞	..	4 18 8
Do. 4½ % First Mort. Deb.	Stock	4½	4½	96 — 99	..	4 11 0
Do. 3½ % Mort. Deb.	Stock	3½	3½	82 — 84	..	4 3 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 —102	..	4 18 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9½ — 10¾	..	5 17 3
Oxford	5	7	7	5⅞ — 6⅜	..	5 10 0
St. James' and Pall Mall, Ord.	5	10	12	9½ — 9⅝ xd	..	6 4 6
Do. 7 % Pref.	5	7	7	6⅝ — 7⅛ xd	..	4 18 3
Do. 3½ % Deb.	100	3½	3½	83 — 86	..	4 1 4
South London, Ord.	4	5⅛	5⅛	2⅞ — 3⅛	..	6 15 4
Do. 5 % First Mort. Deb.	100	5	5	93 —101	..	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1⅜ — 1⅝	..	5 6 8
Do. 4½ % First Deb. Stock	100	4½	4½	97 — 100	..	4 10 0
Urban, Ord.	£3	Nil	..	⅝ — ¾	..	..
Do. 5 % Cum Pref.	5	3½	4	3⅜ — 3⅝	..	6 18 4
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 8
Westminster, Ord.	5	10	10	8⅜ — 8⅞	..	5 12 8
Do. 4½ % Cum Pref.	5	4½	4½	5 — 5⅛	..	4 5 9

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ And Bonded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations Aug. 4th.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	£	6	6	5⅞ — 5⅞	..	5 11 7
Calcutta, Ord.	£	8¾	9	7½ — 7⅝	..	5 16 2
Do. 5 % Pref.	£	5	5	4 13/16 — 5 3/16	—1/16	4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	86 — 88	.	5 13 8
Canadian Gen. El. Com.	$100	7	8	95 —100	—2	8 0 0
Do. 7 % Pref.	$100	7	7	116 —121	..	5 15 10
Cordoba Lt., Power and T., Ord.	£	7/16	⅝		..	7 12 0
Do. 5 % Deb.	100	5	5	81 — 86	..	5 16 8
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	80 — 85	—1½	7 1 2
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	95 — 98	..	5 2 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	98 — 95	..	5 5 3
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	½ — ⅝	..	Nil
Do. 6 % Pref.	£	6	4	½ — ⅝	..	8 0 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	99 —102	..	4 18 0
Madras, Ord.	£	Nil	..	1½ — 1⅝	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	104 —107	..	4 13 6
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	61 — £6	..	7 11 8
Mexican Lt. & Power, Common	$100	4	4†	44 — 47	..	..
Do. 7 % Cum. Pref.	$100	7	7	69 — 74	..	9 9 2
Do. 5 % 1st Mort. Gold Bds.	..	5	5	79 — 84	..	5 19 1
Do. 5 % 2nd Mort. Bonds	100	5	5	60 — 65	..	7 18 10
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	* 100	1912. 5	1913. 5	48 — 53	..	£ s. d. .. ..
Montreal, Lt., H. and Power	$100	9	10†	225 — 235 xd	—2½	4 5 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	10 — 20	..	..
River Plate, Ord.	Stock	10	10	235 —245	..	4 1 8
Do. 6 % Non-Cum. Pref.	Do.	6	6	97 —103	..	5 16 6
Do. 5 % Deb. Stock	Do.	5	5	99 —101	..	4 19 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water. Capital	$100	5½	6	120 —130	—10	4 12 4
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	103 —106	..	4 14 4
Do. 4½ % Per. Deb.	Stock	4½	4½	100 —102	..	4 8 3
Toronto Power, 4½ % 1st Deb.	Do.	4½	4½	98 —100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	82½ — 84½	..	5 18 4
Victoria Falls Power, Pref.	£	6	6	⅜ — ½	..	8 0 0
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105	..	5 14 3

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Aug. 4th.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	£	7	7	11/16 — 12/16	..	8 12 4
Do. 6 % Pref.	£	6	6	23/32 — 24/32	..	7 2 3
Babcock & Wilcox	£	16	16	29/32 — 30/32	..	5 11 4
Do. Pref.	£	6	6	1 5/16 — 1 7/16	..	4 8 6
British Aluminium, Ord.	£	..	5	1 1/16 — 1 1/8	..	4 14 1
Do. 6 % Cum. Pref.	£	6	6	32/32 — 33/32	..	6 9 0
Do. 5 % Prior Liens Debs.	100	5	5	95 — 98	..	5 2 0
Do. Deb. Stk.	100	5	5	88 — 93 xd	..	5 7 6
B.I. & Helsby Cables	£	10	13	10½ — 10⅝	..	6 1 0
Do. Pref.	£	6	6	5⅝ — 6⅝ xd	..	4 12 4
Do. Deb.	100	4½	4½	106 —108	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92 — 94	..	4 15 9
British Westinghouse, Pref.	£	Nil	5	1 1/16 — 1 1/8	—1/16	5 11 8
Do. Deb.	100	4	4	72 — 75	..	5 6 8
Do. 6 % Prior Lien	100	6	6	101 —104	..	5 16 6
Browett, Lindley, Ord.	£	..	..	2/- — 3/-	..	Nil
Do. Pref.	£	..	..	8/- — 8/6	..	Nil
Brush, 7 % Pref.	£	Nil	..	0 — ½	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	80 — 85	..	5 17 8
Lo 4½ % Deb.	100	4½	4½	52 — 57	..	7 17 10
Do. 4½ % Second Deb.	100	4½	4½	29 — 33	..	13 12 8
Callender's Cable	£	15	15	11½ — 12½	..	6 2 5
Do. Pref.	£	5	5	5 — 5¼	..	4 15 3
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Castner-Kellner	£	20	22½	2½ — 2⅝	— ⅛	9 0 0
Do. Deb.	100	4½	4½	104 —107	..	4 4 1
Dick, Kerr	£	Nil	..	⅜ — ½	..	..
Do. Pref.	£	6	6	⅝ — ¾	..	6 17 2
Edison & Swan, A, £2 paid	£	Nil	..	1/16 — 1/8	..	Nil
Do. fully paid	£	Nil	..	1 — 1½	..	Nil
Do. 4 % Deb.	100	4	4	57 — 61	..	6 11 1
Do. 5 % Second Deb.	100	5	5	61 — 66	..	7 11 6
Electric Construction	£	5	5	15/32 — 17/32	..	8 8 6
Do. Pref.	£	7	7	1 — 1⅛	..	6 4 5
Greenwood & Batley, Pref.	£	7	7	6⅞ — 7⅛	..	9 18 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref.	£	6	6	10½ — 11	..	5 9 1
Do. Deb.	100	4	4	88 — 92	..	4 7 0
Henley's, Ord.	£	15	20	14½ — 15½	..	6 9 0
Do. Pref.	£	4½	4½	4⅞ — 5⅛	..	4 7 10
Do. Deb.	100	4½	4½	99½ — 101½	..	4 8 8
India-Rubber, G. & T.	£	7½	7½	8¼ — 9¼	..	7 18 0
Do. Pref.	£	5	5	9 — 9¾	..	5 2 7
Telegraph Construction	£	20	20	37½ — 39½	..	6 1 7
Do. Deb.	100	4	4	97 — 99	..	4 0 10
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	..	63 — 67	..	5 19 8
Do. B 4 % Cum. Pref.	100	..	£4	37 — 41	..	9 15 1

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Aug. 4th.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	£	4½	4½	5⅝ — 6⅛	..	7 4 0
Do. 5 % Deb. Red.	Stock	5	5	95 — 98	..	5 2 0
American Telep. & Teleg., Cap.	$100	8	8	119 —124	..	6 9 0
Do. Collat. Trust	$1000	4	4	90 — 93	..	4 6 0
Anglo-American Telegraph	Stock	8	8	64 — 67	..	4 9 7
Do. 6 % Pref.	Do.	6	6	107 —109	..	5 10 7
Do. Def.	Do.	30/-	30/-	22½ — 23½	..	6 9 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	£	8	8†	7 — 7½ xd	..	5 10 4
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	80 — 82	..	4 17 7
Cuba Telegraph	£	6	6†	8 — 9	..	6 13 4
Do. 10 % Pref.	£	10	10	16 — 17	..	5 17 8
Direct Spanish Telegraph, Ord.	£	4	4	3¾ — 4	..	5 0 0
Do. 10 % Cum. Pref.	£	10	10	7½ — 7¾	..	6 9 0
Direct United States Cable	£	10	4	6⅝ — 6¾ xd	— ⅛	5 16 8
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	129 —132	..	5 6 8
Do. 8½ % Pref. Stock	Do.	8½	8½	76½ — 78½	..	4 9 2
Do. 4 % Mort. Deb.	Do.	4	4	95½ — 97½	..	4 2 1
Eastern Extension	£	10	7	12⅜ — 13	..	5 7 9
Do. 4 % Deb.	Stock	4	4	96 — 98 xd	..	4 2 0
Globe Telegraph and Trust	£	10	6†	11 — 11½	..	5 4 4
Do. 6 % Pref.	£	10	6	12⅜ — 13½	..	4 11 4
Great Northern Telegraph	£	10	20	31 — 33	..	6 1 3
Indo-European Telegraph	£	25	13	57 — 60	..	5 8 4
Mackay Companies Common	$100	5	5	80 — 85	..	5 17 8
Do. 4 % Cum. Pref.	$100	4	4	67 — 72	..	5 10 1
Marconi's Wireless Telegraph	£	20	20	1½ — 1⅝ xd	— 3/32	12 3 0
Do. 7 % Cum. Partic. Pref.	£	17	17	1½ — 1⅝ xd	..	11 6 8
Monte Video Telephone, Ord.	£	6	6	7/8 — 15/16	..	6 8 0
Do. 5 % Pref.	£	5	5	29/32 — 31/32	..	5 18 6
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	98 — 100	—2	4 10 0
Oriental Telep. and Elec.	£	10	10	2 3/32 — 2 5/32	..	4 7 6
Do. 6 % Cum. Pref.	£	6	6	1 29/32 — 1 31/32	..	4 18 5
Do. 4 % Red. Deb.	Stock	4	4	86 — 88	..	4 11 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	95 — 97	..	4 2 8
Reuter's	£	10	7	7 — 8	..	8 15 0
Submarine Cables Trust	Cert.	6	6	127 —130	..	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	97 — 99	..	4 11 0
United River Plate Telephone	£	8	6†	6½ — 6⅝	..	6 0 9
Do. 5 % Cum. Pref.	£	5	5	5 — 5⅛	..	4 11 0
West Coast of America	£	2½	2½	N	..	Nil
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	£	1½	1½	1 — 1½	— ⅛	10 0 0
Do. 6 % Cum. 1st Pref.	£	6	6	8 — 9	— ¼	6 13 4
Do. 6 % Cum. 2nd Pref.	£	6	6	8¼ — 8½	..	6 16 9
Do. 5 % Debs.	100	5	5	98 —101	..	4 19 0
Western Telegraph, Ltd.	£	7	7	13⅜ — 13⅝	..	5 0 11
Do. 4 % Debs.	Stock	4	4	91½ — 97½	..	4 2 1
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	95 — 100	..	4 10 0

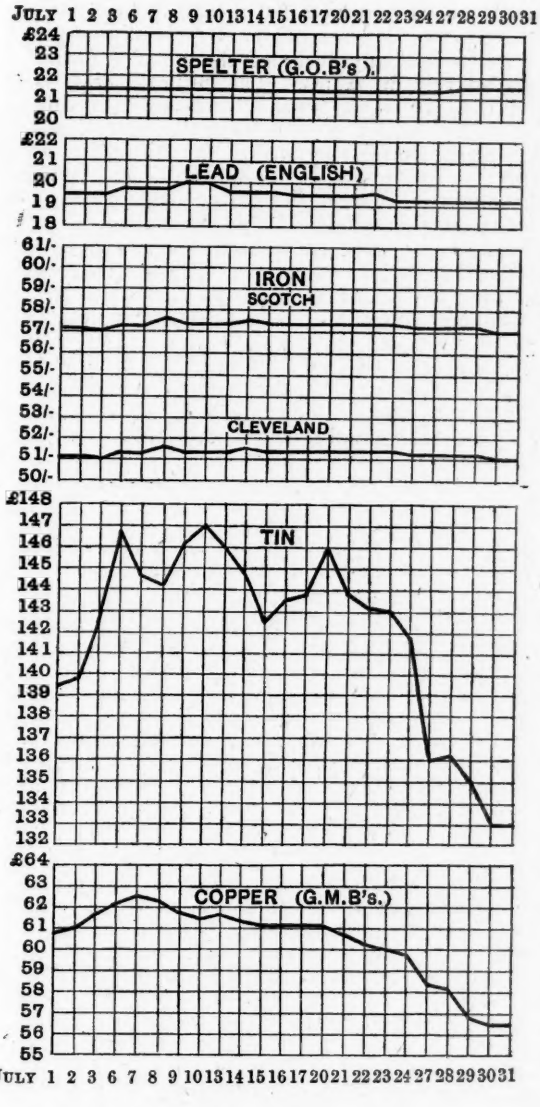
* Unless otherwise stated all shares are fully paid. † Interim dividend. a Paid in deferred interest warrants.

Bank rate of Discount 10 per cent., August 1st, 1914.

A German Electricity Monopoly.—As the Defence Tax has by no means resulted in the realisation of the expected amount of money, various proposals are under consideration in Germany for opening up new sources of State revenue. Apart from suggested Government monopolies in the manufacture of cigarettes, which would yield an estimated annual profit of £6,000,000, and in the production of potash salts, the question of legislation in regard to the supply of electricity, if not in regard to electrical manufacturing, is also held in prospect in the near future. As far as electricity supply is concerned, the fact may be recalled that the financial reform scheme of 1909 contained a proposal to impose a tax on the consumption of electrical energy, but the general opposition which was manifested caused the proposal either to be rejected by the Reichstag or to be abandoned by the Government. The Reichstag has, however, never considered the problem in the form of a suggested monopoly of electricity supply. Besides, there are serious difficulties in the way, inasmuch as certain States, as, for instance, Bavaria and Baden, have proceeded, or are in the act of proceeding, with the development of their own water powers, so that they would scarcely be disposed to agree to be included in any legislative scheme for the whole of the country. It would, however, be possible for these States to legislate independently, leaving the largest State—Prussia—to undertake a scheme of its own. On the other hand, the manufacturing firms stand on a different basis. At the most it is considered that legislative action might be expected to secure freedom of trading as between the smaller and large undertakings although it cannot be foreseen how the adoption of such a measure would contribute financially towards the Imperial exchequer.

METAL MARKET.

Fluctuations in July.



Manufacture of Ammonia from the Nitrogen of the Air.—In the *Wissenschaften* Mr. Otto Serpek has given an interesting description of his new process for manufacturing ammonia from the nitrogen of the air. The first step consists in producing aluminium nitrite, which is decomposed by means of water into hydrate of alumina and ammonia. Serpek found that it was easier to produce the nitrite from an impure clay than from pure clay, because the impurities acted as catalytic agents. Iron, in particular, was an excellent catalyst, and bauxite was consequently a very good material. Of other catalysts might be mentioned nickel, manganese, silicic acid and titanic acid, which could be added to pure clay so that the material would act as well as bauxite. It would be possible to produce the nitrite at low temperatures (1,250-1,300°), but the process would then require considerably more time (5-6 hours), and other difficulties were met with. At a somewhat higher temperature the reaction required about half an hour, and at 1,900° only five minutes. The decomposition of the aluminium nitrite by means of water is effected by heating under a pressure of 2 to 3 atmospheres. The process requires from 3 to 4 hours, and may be described as follows:—

$$Al\,N + 3\,H_2O = Al\,(O\,H)_3 + N\,H_3.$$

After the distillation of the ammonia had taken place, a pure hydrate of alumina could be produced from the remainder. The Serpek process has up to the present time only been employed in an experimental plant at Saint Jean de Maurienne, in Savoy, but it is now going to be exploited commercially and on a large scale; there is under construction a large factory at Arendal, in Norway, and another in the United States, for this purpose

REVIEWS.

Electrical Photometry and Illumination. By Hermann Bohle. London: Charles Griffin & Co., Ltd. Price 10/6 net.

This work, which is of interest both to physicist and engineer, is by far the best book of its kind which we have yet seen, and contains much to recommend it to all who are interested in any way in the art of illumination.

In the first chapter photometric units and standards are very completely dealt with, and in this respect the opening pages will be of more than ordinary interest to the physicist and research student.

Radiation and its effects are treated in the chapter following, and most of the ordinary forms of apparatus used for the production of light by electrical means are very fully explained.

Photometric apparatus forms the theme of the third chapter, and this portion of the subject is more fully dealt with by Dr. Bohle than by any other author whom we have yet come across. In this chapter appears a table the use of which is not perfectly clear at first sight, and we think that a little further explanation would be desirable. One or two of the explanations could also be improved upon, in spite of the clear illustrations of the various instruments described. In the description of the Holophane lumeter the figure "o" appears instead of the word "zero," so that one, unless entirely familiar with the instrument, is liable to be led astray, owing to the "o" being a reference for a certain piece of apparatus shown in the diagram. The Ulbricht sphere is described very fully, together with the mathematics thereof, but we think that the chapter as a whole should be read with extreme care, otherwise confusion is likely to result.

Chapter four deals with light flux and distribution, and again the subject is splendidly treated, both from a mathematical and practical point of view. After a number of paragraphs on the arc lamp, the author dilates upon the flame arc; some striking figures are given showing the screening effect of lower carbons of arc lamps. A number of pages are devoted to illumination, and we can, with confidence, advise their perusal. The testing of lamps is next dealt with, and should be of service to those interested in lamp manufacture. The variation of candle-power with voltage is very fully treated, but we do not see any reference to the influence of the specific heat of the material composing the filament upon the candle-power when variations occur as in an alternating-current circuit. A number of paragraphs are devoted to the testing of arc lamps, and several opinions put forward by the author should be of service to those who have to deal with illumination. We think that the tables at the end of these paragraphs could, with advantage, be explained rather more fully. There is a great deal of information upon the Moore tube, which will be helpful to those considering its installation.

We must confess disappointment with the following chapter, which purports to deal with the "Design of Reflectors and Shades," and feel that this heading is somewhat unfortunate. We are also somewhat surprised that the credit for the Holophane should be given to Messrs. Blondel and Psaroudaki, since we were under the impression that they were merely the first persons to treat this material on a commercial basis.

We are pleased to see in the next chapter, which treats of illuminating engineering, many details usually overlooked by those planning installations brought well to the front, notably the question of shades. Though slightly out of date, the information regarding the illumination of various buildings, etc., is very useful, and many important points are

emphasised. The tests given are interesting, but there is much room for improvement in the examples given, many of the features illustrated scarcely agreeing with the author's previous comments. The facts and figures regarding indirect illumination also require careful revision. The table, summarizing American and Continental varieties of standard specifications for street lighting, should be of service, as should also the examples worked out in the pages following. It is to be regretted that a few paragraphs further on the author, in comparing costs, bases his figures upon candle-power, and not upon illumination. The hygienic aspect of electric lighting is dealt with in the following paragraph, and is representative of the author's thoroughness in his work.

Following the text are a number of appendices, and also a very complete list giving the principal papers and communications which have appeared since 1906. This list, together with the foot-notes, increases the usefulness of the book to a very large extent.

Applications of Electricity. By A. Ogilvie. London: T. C. & E. C. Jack. Price 6d. net.

This is one of the few inexpensive books in which is presented a sufficiently accurate and detailed explanation of the chief everyday applications of electricity, in simple language and without extravagance of phrase or metaphor. Under Battery Current Applications, the author deals with electric bells and clocks, telegraphs and telephones, etc., and under Dynamo and Current Applications, he describes electric lamps, electric heating and power applications and electro-chemistry. No more than elementary facts are outlined, but by aid of the numerous diagrammatic illustrations, no reader should have any difficulty in understanding the *modus operandi* of the apparatus and applications described.

Questions and Solutions in Magnetism and Electricity. By W. J. White. London: S. Rentell & Co. Price 1s. 6d. net.

The author presents model answers (illustrated when necessary) to questions set by the Board of Education and City and Guilds of London Institute in Stage I of Magnetism and Electricity during the years 1907-1913. Where the answer to a certain question is identical with or a mere variation of that given for some earlier question, the author avoids repetition and waste of space (besides in many instances affording valuable insight into the correlation of various problems) by giving cross references. Any student giving these answers would be assured of a First-Class Certificate, and this excellent little treatise is to be recommended heartily to all students as showing how examination questions should be answered, sufficiently but tersely; as providing a convenient means of revising knowledge previously obtained; and as forming a catechistic text book of no mean order. A concise index increases materially the value of the work.

Slide Rule Notes. By H. C. Dunlop and C. S. Jackson. London: Longmans, Green & Co. Price 2s. 6d. net.

Based on an earlier and less complete pamphlet, this work represents a complete exposition of the uses to which may be placed an ordinary 25-cm. slide rule of the Mannheim type. It is safe to say that the ordinary engineer—who generally uses his rule for multiplication and division, and occasionally ventures to determine simple trigonometrical functions by its aid—will be amazed, not to say overawed by the diversity of operations to which the "guessing stick" may be applied. Full appreciation of these applications can only be obtained by practice, and some of them are rarely required by the average engineer. Nevertheless study of the treatise is to be commended to mathematical and engineering students, and the volume should certainly be taken for reference on any field work in the course of which unusual calculations may arise. Where special calculations have frequently to be made and high accuracy is essential, it is generally advisable to use a specially designed slide rule or, in some cases, to rely on tables. The authors show, however, that the scope and accuracy of the ordinary slide rule are much greater than generally realised. They explain clearly by words, illustrations and examples its use in simple multiplication and division; in evaluating square and cube roots and trigonometrical functions; the use of logologarithmic and central scales; and the solution of equations and plotting curves from equations. The effect on results of errors in working is discussed in Chap. IX, and a valuable collection of miscellaneous notes and mnemonics is presented in Chap. X. Anyone who has worked conscientiously through this book will be well aware of the exact capabilities and limitations of the ordinary slide rule, and will have no difficulty in understanding the theory and use of more elaborate instruments.

Handbook of Wireless Telegraphy. By J. Erskine-Murray, D.Sc. Fifth edition. London: Crosby Lockwood and Son. Price 10s. 6d.

Further additions and revisions have been made in this book of copious information on the mysteries of wireless telegraphy, which still preserves its bright and airy but irresponsible style of compilation. Considerable additions have been made under the headings of uniform alternating current and shock excitation systems, and new matter has been added in various parts in the endeavour to bring the work in line with modern advances. It would, however, be an advantage if, at the same time, some of the older chapters were excised. In spite of this disadvantage the book contains much useful and interesting information, and the illustrations throughout are specially good and well printed. The Reviewer must, however, again join issue with the Author on his imperfect and misleading treatment of the electrical properties of the atmosphere as given in Chapter XVI. He appears to regard conductivity as a normal condition of rarefied air instead of abnormal. An exhausted bulb is not, at any pressure, normally a conductor of electric currents. It must be ionised by some means before conductivity sets in. The Author does not appear to hold this view, or at any rate it would not be gathered from the statements he makes.

Chapter XVI also contains a useful *résumé* of Dr. Austin's long distance measurements and results in the United States. In an earlier chapter the Goldschmidt alternator receives an increased share of attention and certain particulars of working results are given.

ESTABLISHMENT CHARGES.

By T. B. L. NEWSTEAD, A.M.I.E.E.

Whilst the careful determination of the establishment charges incidental to a modern engineering manufacturing business, and the correct allocation of the same, is a matter of the greatest importance, it is, nevertheless, one that in the majority of cases does not receive nearly such close attention as it should; in many firms the question is practcially overlooked, and no effort is made to compare periodically the overall costs of the goods manufactured with the prices obtained, in order to see whether actual profits

are being made or the work carried on at a loss. By some it is apparently considered sufficient to take a rough monthly balance from the value of the stock withdrawals and materials used, the total cost of supervision, labour, and all other expenses, and to set these against the value of the goods invoiced or turned into the finished-material stores, with a view to gauging the relative profits made; but, though this may give some idea of the position of affairs in small concerns, it cannot be deemed at all a satisfactory method of arriving at actual results or of showing what are the total costs of the various articles made.

If more careful attention were given to this subject from month to month, it would be much easier accurately to gauge the progress of the business without waiting for the annual stocktaking and balancing of accounts, and thus many business failures might be guarded against.

To make allowance for the cost of establishment charges in estimating the costs of manufacture, it is usual to calculate these as a percentage of the labour charges relating to the work in question, which percentage will vary considerably with the nature and size of the business and the extent of the organisation required to sell the goods manafactured, and it may amount to anything from 50 per cent. to 200 per cent. or more upon the actual cost of the productive labour involved. In some cases—though more rarely—a small percentage of 5 per cent. to 10 per cent. is also added to the cost of materials to cover interest, handling, and other expenses incidental thereto.

Although these allowances are made for estimating, and also in some cases for costing, purposes, it is very rarely indeed that any steps are taken to make a monthly comparison between the amount of the actual establishment or standing charges and the corresponding cost of the productive labour, with a view to finding out whether the calculated percentage allowed for is correct or not, and consequently whether the work is being carried on with a satisfactory margin of profit.

It should be a very simple matter, however, at the end of each month to calculate and total up all the standing charges for the month, comprising such items as rents, rates and taxes, lighting, heating, water and power supply; works supervision charges; designing and testing, in so far as it is not possible to have these charges actually booked up to the work in progress (which should be done as far as practicable); and any other incidental expenses involved. In addition to these there will be the head and branch office expenses, staff salaries, and the selling and advertising charges generally; and, on the other side, there will be the total productive wages bill for the month, so that a ratio can be arrived at each month between these two totals from which a more accurate covering figure for costing purposes can be arrived at. This should not vary very considerably from month to month, though naturally it will tend to go down during times of prosperity and as the volume of business increases, and to rise when trade is bad. It is in the latter case particularly that a more accurate knowledge of what is taking place is desired, as otherwise disaster may result owing to orders being accepted at too unremunerative prices.

The writer would therefore suggest that it would be found a good plan to open an establishment charges account in the books, which would be debited with all charges coming within this category; and that each manufacturing shop order, upon which work has been done during the month, should be debited at the end of the month with an amount for establishment charges, calculated at the proper percentage upon the total cost of the labour charged to that order during the month in question: this percentage would be arrived at in the manner already explained, and the nearest round figure would be taken above the actual ratio of the total establishment charges to the total cost of productive labour for the month. The establishment charges account would at the same time be credited with the various amounts debited to the shop orders, with the result that the account would always show a small balance upon the right side, which would be carried to the profit and loss account at the end of the financial year.

In this way each shop order would automatically bear its due share of standing charges, and it could be seen at any moment whether the work was being done at a profit. In cases where it might be necessary to make up the total cost of a completed shop order before the end of the month—for invoicing or other purposes—it would be permissible to calculate the establishment charge upon the basis of the previous month's percentage, and any discrepancy that might occur by doing so would no doubt be covered by the small credit balance allowed for in the establishment charges account.

In the case of such standing charges as rent, rates and taxes, and other items, which are usually only chargeable at intervals of three or six months, it would be quite a simple matter to split these up into equivalent monthly amounts and charge them to the account accordingly; and in businesses where the works and head offices are separate, either structurally or in organisation only, it may be convenient to separate the standing charges into two accounts, viz., works establishment and head office establishment—the latter including the whole selling organisation—with a view to being able to arrive at the works cost of the goods manufactured apart from the total company's cost.

ELECTRO-DEPOSITING NICKEL: ITS APPLICABILITY TO THE PRINTING TRADE.

By G. BASIL BARHAM, A.M.I.E.E.

In commercial electro-deposition, experience has shown that the amount of chemical deposition is directly proportional to time and strength of current. This is made use of in what is known as quick electroplating, in which a heavy current is used for a short time, a method largely employed in the making of electrotypes for illustration work. It is claimed that slow deposition gives the most satisfactory results. There are of course other conditions to be taken into account, such as the back E.M.F. of the plating bath and the total resistance of the electrolytic circuit. The distance apart, in commercial work, of the electrodes is not of much importance, and the current density and consequent rate of deposit is usually determined by financial considerations. With an expensive metal it is generally advisable to increase the difference of pressure applied, which results in a certain increased loss of energy, but a higher current density and quicker rate of deposit. This secures an increased works efficiency, as there is only a short time between the introduction and the withdrawal of the crude metal from the bath. Interest on capital, and time, are of far more value in a works than might be imagined by a man used to working under perfect laboratory conditions, and there is much done in practice which theoretically might be held to have certain drawbacks.

Recently the electro-deposition of nickel has received much more attention than was formerly the case. Printers have realised that it pays to nickel-plate electro- and stereotypes, and the result is that there is an increasing demand for small electro-depositing plants which is not at present adequately

met. Further, a campaign directed towards exploiting the printing field would certainly have lucrative results. The big printer knows all about the new process which doubles and trebles the "runs" he can get from his blocks; in many cases he has his own plating plant, but in most instances he purchases nickel-faced stereos and electros from one or two of the makers who specialise in such goods. The smaller printer, once the advantages of nickel-facing are brought home to him, may well invest in a vat at a cost of a few pounds and carry out the work himself. Electrical contracting firms would probably find it profitable to lay down a plant and do work for printers in their vicinity, and in their case it would pay to undertake plating work of every description.

The advantages from the printers' point of view of nickel-plated blocks are that the metal is non-oxidisable, it is practically as hard as hardened steel, it takes ink well, and gives off, as it is termed, much better than copper. In many of the red and other inks used by the printer mercury occurs, and whilst this substance attacks copper it has no effect on nickel. Another advantage is that it sharpens up work. Every printer who has a knowledge of photogravure work and has examined closely prints of a plate before and after facing, will quite understand the difference nickel-plating can make to a good half-tone block or electro.

In connection with nickel-facing, it may be pointed out that in a commercially pure state, nickel is slightly stronger and harder than iron; cast nickel has a tensile strength of about 20 tons to the square inch, and when rolled this strength is increased to about 32 tons per square inch. If 11½ per cent. of nickel is added to steel the tensile strength of the alloy is roughly 90 tons per square inch, whilst that of the steel before treatment would be in the neighbourhood of 30 tons. This peculiarity is evidently at the bottom of the fact that nickel-faced printing surfaces stand the wear and hammer of a press so much better than stereos or electros of a comparatively soft metal like copper. The coating need not be heavy; in fact, at the present time the practice is to put a very light deposit of nickel on the printing face, although there is no doubt that for lasting work the coat might be made heavier with advantage. After all, the life of a block depends on the hardness, toughness and durability of the metal from which it is made, the hardness and surface of the paper used, the impression, the packing, the speed at which the press is worked, the condition of the machine and the composition of the ink, that is, as to whether it has an earthy base or not. So that, when these are taken into consideration, it would seem that there would be a certain advantage in giving the surface a fairly thick coating.

Everyone is familiar with the plant required; the nickelling vat, the low-voltage dynamo, the shunt regulator, resistance board and electrodes, connections and hooks. A cleaning vat in which lyco can be heated, a scouring bench and swilling trough, a hot-water tub and some brushes make up the equipment. An electro-coppering bath is also one of the necessities when dealing with stereos as well as electros. The size of the plant depends on the size of the stereos to be dealt with, and whether they are for a rotary or flat bed machine. Those for the latter pattern naturally require a larger bath than do those used on machines generally found on the premises of printers who do not carry out newspaper and similar large work.

The nickel-facing process only takes about twenty minutes, so there is little force in the argument that the process might delay work or keep presses standing. The stereo is first cleaned by washing in the lyco bath, after which it is scrubbed and swilled with clean water. It then goes to the coppering bath, and if it is left in for five minutes a sufficiently thick coating of copper to take the nickel will be deposited. A practised hand will save seconds if not minutes at this by lifting the stereo to see how the coating is progressing, and not leaving the stereo in the vat a moment after the surface is covered. As soon as it can be removed it is swilled with clean cold water and hung in the nickelling vat. When time presses, fifteen minutes with a fairly heavy current will give a surface sufficiently hard to add greatly to the life of the stereo, but a longer immersion gives better results. If the stereos are to have a very long run on the machine or the paper to be used is likely to cause heavy wear, extra time should be given, and a bath of half an hour's duration or even more will not be found too long. After the plate is lifted from the nickelling vat it only requires swilling, first in hot and then cold water, before it is locked up in the chase. It will be seen that the work is not complicated, and as other plates can be cast if required whilst the plating is going on, the addition of a plant to a printing office need not interfere with the ordinary routine of the work. If nickel-faced steroes are used time is often saved, as the plates will last throughout the run and there is no need to stop the press. This also results in an increased output of the machine, inasmuch as it is not necessary to stop it for renewals. Also less make-ready is required. An economy, which in the course of a year will amount to a large sum, is effected in stereo metal; with unfaced stereos it may be necessary to re-cast after 15,000 impressions, and remelting the metal impoverishes it and new metal and "revivers" have to be added. With nickel stereos a run of as many as 250,000 impressions may be given before it is necessary to melt up the plates and re-cast.

In practice it is found that less ink is required, a saving of about 25 per cent. being effected in this direction and a much denser colour is obtained, and with these and other advantages to be used as selling points it would seem that a market which should be by no means difficult to enter lies open to the electrical industry.

UNEMPLOYMENT INSURANCE AMENDMENTS.

By JOS. J. H. STANSFIELD.

It is nearly two years since the National Insurance Act, 1911, came into operation, and as the result of experience gained during that period it has been considered advisable to bring before the present Parliamentary session a Bill to amend that part of the Act dealing with Unemployment Insurance.

The main purpose of this measure is to remove administrative difficulties experienced by the Board of Trade, by employers and by workmen, to diminish the working cost and to amend some of the provisions of the original Act which have been found to cause delay. The Bill does not involve any considerable changes of policy, and is practically an agreed Bill representing the main views and agreements arrived at in conference between the Board of Trade and representatives of employers and workmen.

The Bill, which is now passing through the House of Commons, contains several provisions which only affect Board of Trade administration, but as some of the clauses directly concern most employers connected with the electrical industry it may be of advantage to explain these briefly.

The most important provision to employers is Clause 5, which is intended to simplify the conditions for refunds payable to employers under Section 94 of the principal Act. That section provides that the Board of Trade shall, on the application of any employer made within one month after the termination of a prescribed period of twelve months, refund to

such employer out of the unemployment fund a sum equal to one-third of the contributions (exclusive of any contributions refunded to him under other provisions) paid by him on his own behalf during that period in respect of any workman who has been continuously in his service throughout the twelve months, and in respect of whom not less than forty-five contributions have been paid during that period.

The rigidity of the requirements of this section in respect of continuous employment, etc., has led to considerable inconvenience, some injustice to employers, and general irritation and unpleasantness, difficulties which the new clause appears to overcome, as it simply provides that "the Board of Trade shall, on the application of any employer made in the prescribed manner within two months after the termination of an insurance year, refund to such employer out of the unemployment fund the sum of three shillings in respect of each workman, in respect of whom he has paid not less than forty-five contributions during the insurance year."

The contribution payable by employers on their own behalf in respect of workmen in insured trades, aged 18 and over, is 2½d. per week, and for youths from 16 to 18 1d. per week. As the refund is one-third of the contributions paid it now entails an elaborate statement in order to arrive at the actual contributions made in respect of each workman, and if a workman has been unemployed for a single week during the year no repayment can be claimed.

The amounts at present claimable vary from 3s. 7⅓d. to 3s. 1⅓d. in respect of workmen of 18 and over, and 1s. 5⅓d. to 1s. 3d. in respect of youths, whereas the new clause fixes a definite amount of 3s. in all cases, only requiring such particulars as will prove that 45 contributions have been made each year.

The new clause also provides for an alteration in the ending date of the year, so that the present year-end of July 14th can be altered, and furthermore any contributions which may have been refunded under Section 96 of the principal Act, or from which an employer may be exempted under the provisions of Clause 6 of the Bill in respect of workmen working short time, shall be included in calculating the necessary 45 contributions, subject, however, to the 3s. per workman being proportionately reduced in respect of such refunded contributions or exemptions.

Under Clause 6 above referred to an alteration has been made in respect of Section 96 of the principal Act, the substituted clause providing that the Board of Trade may, where it appears to them that there is exceptional unemployment in any trade or branch of a trade, on application being made by any employer in that trade or branch, exempt both employer and workman from making any contributions, an amendment which will avoid a possible injustice to workmen who, in consequence of their having left the employment of the employer, cannot be repaid any refunded contributions.

Under Section 107 of the principal Act a workman is defined as a person other than an indentured apprentice of the age of 16 and over who has entered into "a contract of service with an employer. The words "contract of service" have resulted in exempting certain employés of a local or other public authority, and under Clause 10 of the Bill such employés will now be insurable.

Clause 10 also requires the insuring of a workman in an insured trade whilst he is following any other occupation from which he derives any remuneration or profit greater than that which he would derive from the receipt of employment benefit, unless such other occupation has ordinarily been followed by the workman in addition to his employment in an insured trade and outside the ordinary working hours of such trade, and the rate of remuneration received therefrom exceeds fifteen shillings per week.

An amendment is made in respect of meetings of Courts of Referees by which cases referred to them may, with the consent of the claimant, be proceeded with in the absence of one or more members of the Court other than the Chairman. The cases referred to Courts of Referees have been much fewer than was expected, and any cases arising out of arrangements made with associations of workmen in insured trades who make payments to members whilst unemployed may, under Clause 8 of the Bill, be referred to them as well as to the Umpire.

The principal Act provides that a contribution shall be made in each year out of moneys provided by Parliament equal to one-third of the total contributions received from employers and workmen during that year. Considerable time and expenditure must have been required to arrive at the amount payable, and the Bill provides that so long as the payment of contributions is made by means of stamps affixed or impressed upon books or cards, the sums received by the Postmaster-General during the year on account of such stamps after deducting any sums which may have been refunded shall be deemed to be the contributions of the year.

It is stated that the Bill will not increase the total charge on the Treasury, and at the same time will give relief to employers and workmen, the simplification of procedure enabling savings to be effected which can be devoted to the relief of administrative burdens and the removal of grievances. On the new basis of calculation referred to above it is anticipated that the State will pay into the funds £30,000 less per annum than at present.

The results of the principal Act are of much interest. On May 22nd last there was a balance in the hands of the National Debt Commissioners, the Postmaster-General and sub-accountants of £3,023,000, and as £30,000 per week is being paid over, a considerable sum should be in hand to tide over the next period of bad trade. On the 15th May 2,286,000 workmen were insured, and during 16 months 1,481,000 claims had been made and £700,000 paid out in benefits.

It is claimed that the Act has not only stimulated organisation amongst working men but has also induced numbers of employers to increase the stability of their employment and regularise their work. No one can reasonably object to a reduction in the curse of casual employment with its demoralising results.

Employers and workmen may look forward to the early inclusion of other trades as insured trades, and it is hoped that such savings may be effected as will enable benefits to be increased or contributions reduced. If the latter happens there will be much cause for thankfulness, but there will be diverse opinions on the proposal that the Act should be placed on a non-contributory basis. The powers that be do not consider that this is practicable at the present moment, but it is not denied that something of the sort may be ultimately adopted.

WATER-POWER IN FINLAND.

Some further information is forthcoming which supplements that which was given in this journal on May 22nd in regard to the proposed utilisation of water power in Finland, with special reference to the Imatra falls, in the Vuoxen river. Two separate schemes have been engaging attention for some time past. As was mentioned in the Review at the time, the three electric lighting companies in St. Petersburg, headed by the St. Petersburg Electric Lighting Co. of 1886, and supported by Russian and German banks, co-operated in the formation in November, 1912, of the Imatra, Société pour l'Exploitation et la Distribution d'Energie Electrique of Brussels, the share capital being £1,200,000. The second project was brought forward as a competitive proposal by Mr. Rattner, State Councillor, and resulted in the constitution of the St. Petersburg Electric Transmission of Power from Waterfalls Co., with a share capital of £600,000.

The river Vuoxen, which flows from the great Saisna lake, forms a number of successive falls and rapids at short dis-

tances apart. The most important is the Great Imatra fall, which is owned by the Finnish State, whilst the other falls are in the possession of private individuals and are divided among numerous proprietors, so that exceptional difficulties stand in the way of uniform utilisation. After protracted preliminary labours the St. Petersburg Co. of 1886 succeeded in assuring itself of all the requisite sites and rights for the use of the Vallinkoski or Little Imatra fall, which is capable of yielding 60,000 horse power, and the before mentioned Belgian company, with the assistance of Belgian and Swiss institutions, was established to finance the scheme and also to finance a new station for the outskirts of St. Petersburg. This station is already in operation and is intended, later, to provide for the disposal of a portion of the power to be transmitted from the Little Imatra. As the St. Petersburg Co.'s rights are of a private nature they do not depend upon the grant of a State concession. It has, however, been necessary to apply to the Finnish Senate for sanction to close the "king's vein"—a water gate which is kept open for a portion of the year for the purposes of the fishing and timber floating trades—in order to obtain increased water power, and also for authority to expropriate sites for the erection of transmission lines to Viborg and St. Petersburg.

The St. Petersburg Electric Transmission of Power Co., which was constituted in the meantime with the co-operation of Belgian (Mottard Frères) and French (Hector Legru) capitalists and of various banks in the Russian capital, entered into competition by seeking to acquire possession of other portions of the water powers of the Vuoxen river. Full rights were obtained for the Siitola falls of about 25,000 horse power, and partial rights were secured for the Rouhiala falls, which are estimated at 40,000 horse power. It is, however, stated that owing to the technical conditions the former could only be utilised by incurring a disproportionately high expenditure and that the falls could therefore not be worked economically. On the other hand, in consequence of the great diversity of ownership and the complication of the water rights, the possession of the Rouhiala falls has not been sufficiently assured, and for this reason it is considered that many years would probably elapse before it would be possible to think of exploiting these falls.

It was under these circumstances that the Electric Transmission of Power Co. conceived the idea—which is said to have formerly been proposed by English promoters—of constructing an artificial canal for the diversion at another place in the lake of the whole, or nearly the whole, of the water now flowing into the Vuoxen river; the water would be diverted from the natural falls in the river and would be returned to the river after serving the purpose of the projected generating station. In this way, all the falls and the total power of the separate natural falls would be combined in one place to the extent of 300,000 horse power, but the water would be withdrawn from the present river and the individual falls in private ownership and the existing industrial establishments would be rendered of no value. The company, therefore, asked the Finnish State to sanction the construction of the canal, and, at the same time, to grant the right of expropriating all the water powers, rights and industrial establishments which would be ruined by the execution of the scheme.

The Finnish Senate thereupon appointed a commission, consisting of the leading technical and legal officials, to examine the canal scheme, leaving the other question out of consideration for the time being. According to the report which has recently been published, the Commission recommends the Senate to reject the scheme, both for technical and economic reasons. The report points out in the first place that the project would enable about the same amount of power to be utilised as in the case of the individual natural water powers being worked, but no more. On the other hand, the cost per horse power would be at least 60 per cent. greater, the safety of working would be materially lower, the concentration of the total power in one place and in one ownership would provide an undesirable monopoly without necessary occasion, and the water power owned by the State, and to be reserved for ultimate railway conversion, would be diverted without the scheme offering a single advantage in return. The Commission also considers the project to be an economic mistake, as an adequate market for the power to be won would neither be found in Finland nor in St. Petersburg. As compared with the steam power produced in St. Petersburg with coal cheaply conveyed by sea, the report submits that only that portion of the power from the suggested hydro-electric works could be profitably employed in St. Petersburg for which a continuous demand exists; that is to say, from 20 to 25 per cent. at the most of the total power required there. The remainder could be produced more cheaply by steam power, and the Commission suggests, therefore, that only the individual water powers in the Vuoxen river should be gradually utilised and increased according to the growth in the demands, whilst the company's scheme is recommended for complete rejection.

The Finnish Senate is on the point of taking the report into consideration, and there is said to be scarcely any doubt that the Assembly will endorse the opinion of the Commission. In this event the application made by the St. Petersburg Electric Lighting Co. of 1886, which had been provisionally postponed, will again be free for discussion, and it is thought that the Senate will give its sanction to the expropriation of sites for the transmission lines. On the other hand, the rejection of the Power Transmission Co.'s scheme would cause the latter to revert to the position held a year ago, which is represented by the possession, as previously mentioned, of the Siitola falls and the partial ownership of the Rouhiala falls. Apart, however, from this side of the question, it is stated that the Transmission Co. does not own any concession for the distribution of electrical energy, and has, therefore, no market for the power proposed to be utilised.

COMPRESSED AIR.

The use of compressed air is so common that more than ordinary notice may be taken of the new catalogue, already referred to, which has just been issued by Messrs. Alley & MacLellan, Ltd., of Glasgow, and which contains much useful information. There are points of merit and demerit in all machines, and he must be a good all-round expert who is alive to such points when buying.

The firm named rate their compressors by their actual delivery volume of free air and not by any calculated cylinder volume, and this is as it should be, for it compels makers' attention to the important point of minimum clearance. In the catalogue before us single-stage working is advised up to 40 pounds pressure, for there is not any net saving all round to be obtained by a two-stage machine. But at 100lb. the saving by the two-stage principle may be 15 per cent. if the machine is well designed, is fed with cool air, and has suitable cylinder and intermediate cooling. The air fed to a compressor should not be drawn out of an engine room but from a cold cellar, if possible through a wooden pipe, or better still from a deep well where the temperature will be about 52°F. And such cold air should be heated as little as possible on its way to the compressor cylinder. Compression to 100lb. will add about 450 degrees of temperature to the air, and this is not far short of being able to double its volume. Such a temperature is bad for the oil, which may be cracked by it, causing cylinder grit and friction.

One may save £50 per year on a 500ft. per minute compressor by adopting double-stage work for 100lb. delivery pressure.

It requires 1.31 H.P. to compress 10 cubic feet per minute to 100lb. isothermally, but 1.81 H.P. to do the work adiabatically, or 38 per cent. more. The heat which represents this ultimate loss is all dissipated when the air has made contact with 10 square feet of pipe surface for each indicated H.P. on the compressing cylinder. Undoubtedly there is much truth in the statements as to the general bad design of air compressors and the loss of volumetric efficiency they suffer. In water pumping there are all kinds of ridiculous statements made as to the advantage of the air-lift pump, but the one advantage which has a real foundation in fact is that, from a given bored tube well (especially of small diameter), the air lift will draw out more water than any other system, unless, perhaps, the Mather Reynolds pump would be equal or superior. But the air lift often demands an excessively deep borehole to get its necessary immersion depth, and the deeper the well the greater the inefficiency of the air lift. It is impossible to make independent water supply pay for itself under extreme circumstances as to life, supply, immersion, etc. And when it would pay with an efficient compressor, it may not pay with a poor and inefficient machine. This fact emphasises the need for high efficiency in such water pumping machines, for the air pump is so wasteful to drive that its use is only justified either for small lifts or in deep lifts where a maximum yield must be obtained. Air lifts have more than one reason for being uneconomical: the compression of air is never an efficient process; air is soluble in water and thus much of the compressed air is lost at once, especially in deep lifts, for air solubility increases with pressure. And there must be slip in the rising main which will cause loss.

Then again, oxygenized water is corrosive, and the air lift pump is not that simple thing that it may appear. But a good and efficient compressor should always be employed.

Engineers about to employ air compressors, who wish to use them at high elevation, should be fully alive to the fact that the loss of capacity is 3 per cent. for each 1,000 feet of elevation. Thus at 10,000 feet the output will be 30 per cent. less, but the power required only 16 per cent. less. At 10,000 feet elevation the normal barometer is only 20½ inches. In mine work with electrical transmission the engineer must decide whether to place his compressor at the surface, where it can draw in cold air, or down a deep mine where the air is dense and hot.

Strictly, at high elevations a third taker-in cylinder working on a small pressure rise only should be used to feed the ordinary two-stage compressor.

From this book much help may be obtained, for there are very good practical hints and some useful tables. Obviously compressed air is not for use as a power transmitter, but it is excellent for some portable tool driving and has not yet been beaten for working rock drills in the mine, where it serves the double purpose of a working and of a cooling and ventilating agent.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

NEW ZEALAND.—The New Zealand Customs Authorities have issued the following decisions as to the duties to be levied on certain electrical and similar goods on importation into the Dominion; the duties in each case are those leviable under the preferential tariff on British goods:—Time switch for double tariff electric meters; electric motor cars (other than tramcars)—free: batteries imported with, and being part of, though detached from such car are to be treated as part of the chassis; steel shoes for joining rails by welding—free.

GRENADA.—The Government have decided that machinery, including engines for industries of any kind and all necessary parts and appliances for the erection and repair of such machinery are to be admitted free of duty.

ITALY.—The Italian Customs Authorities have decided that in the case of complex apparatus for lubricating machinery, consisting of a filter for purifying the oil, a refrigerator and pump, the pump is to be dutiable at the rate of 10 lire per 100 kg., and the filter and refrigerator at the rate of 18 lire per 100 kg (25 lire = £1; kg. = 2.204 lb.).

UNITED STATES.—The United States Customs Authorities have issued certain new regulations regarding the method of invoicing goods for importation into that country, by which it is laid down that merchandise purchased or agreed to be purchased for export to the United States must not be included in the same invoice with merchandise obtained otherwise than by purchase or agreement of purchase. An invoice shall include only one shipment of merchandise from the same consignor to the same consignee. Merchandise shipped to different consignees must not be included in the same invoice, but merchandise purchased or agreed to be purchased in the United States and shipped to a branch house or agent of the shipper for distribution or delivery to two or more ultimate consignees may be included in a single invoice. Merchandise purchased or manufactured in different consular districts in the same country and assembled for shipment for one consignee in the same vessel may be included in one consular invoice at the point of shipment. In such cases the certified invoice should have attached thereto the original bills or invoices, if there be any, or extracts therefrom, showing the price paid or to be paid for each purchase or consignment.

The shipper's declaration upon invoices of merchandise shipped in pursuance of a purchase or an agreement of purchase differs materially from the shipper's declaration on merchandise shipped otherwise than by purchase or agreement for its purchase. Two forms of declaration have therefore been prescribed for the use of the shipper:

1. The declaration to be endorsed upon invoices of merchandise which has been shipped in pursuance of a purchase or an agreement to purchase.

2. The declaration to be made on the shipment of merchandise otherwise than by purchase or agreement for its purchase.

Merchandise must be invoiced upon the purchase form of invoice when the price or amount to be paid or remitted therefor is fixed and determined at the time of or prior to the shipment of the merchandise, whether or not the merchandise is shipped directly to the purchaser or is shipped to an agent of the seller or to the seller's branch house in the United States for delivery. Such invoice must show the price paid or agreed to be paid for the merchandise, whether constituting the price for the merchandise delivered in the United States or otherwise. The shipper, may, however, indicate upon his invoice, by marginal notations, in parallel columns, or otherwise, what he considers to be the market value of such merchandise in the principal markets of the country from which it is exported at the time of exportation.

Consuls should satisfy themselves that the proper form of invoice is used, and may, if necessary, require documentary evidence of the nature of the transaction.

If the merchandise has been purchased or agreed to be purchased for export to the United States, the invoice must be made out in the currency paid or agreed to be paid therefor.

If the merchandise is consigned for sale in the United States and is not shipped pursuant to a contract of purchase, the invoice must state the market value in the standard coin currency of the country from which the merchandise is exported, although a depreciated currency may be in circulation there.

The invoice must contain a correct description of the merchandise, using in each item the name, if any, by which the particular variety is known to the trade in the country of production or exportation. The description should show its kind, quality, component parts, and such other characteristics as will enable a person not an expert to identify the merchandise as it is sold in the foreign market and will assist consular and appraising officers in detecting any departure from the actual market value thereof.

The contents and value of the case or package must be separately specified on the invoice. Attached to or included in the invoice must be a statement for statistical purposes specifying the merchandise in the terms of the detailed list or enumeration prescribed by the Secretary of the Treasury and the Secretary of Commerce. This specification must show the total quantity and value of each kind of article included in the invoice.

Vague and misleading specifications should be avoided, and if insisted upon, should be the occasion for a special inquiry and report by the consul. Such specifications may result in expensive complications to the importer and delay in passing the goods through the customs. Invoices must express the quantities of the merchandise in weights and measures of the country of exportation, and may be made out in English or in the language of that country.

If the merchandise is shipped in pursuance of a purchase or agreement to purchase, the invoice must be signed by the seller or purchaser, or by his duly authorised agent. If it is shipped on consignment for sale or otherwise than in pursuance of a purchase or agreement for its purchase, the invoice must be signed by the manufacturer or owner, or by his duly authorised agent.

The signature may be affixed to the invoice at the shipper's place of business, at the consular office, or elsewhere.

At or before the shipment of the merchandise the invoice must be produced (in person or through the mails or by messenger) to the consular officer of the United States for the consular district in which the merchandise was manufactured, purchased or agreed to be purchased, or assembled for shipment, as the case may be, for export to the United States; and shall have endorsed thereon when so produced, if shipped in pursuance of a purchase or agreement for purchase, a declaration signed by the purchaser, seller, or the duly authorised agent of either of them, in a prescribed form. If the merchandise is consigned a different form is required to be signed. If the goods have been purchased or agreed to be purchased, the invoice must set forth the sale price and separately specify all charges and whether or not included in the sale price.

The charges to be specified shall include:—

1. Insurance; commissions; brokerage; inland freight; packing charges, including boxing, tilloting, cartons, packing, and similar charges.

2. The amount of all duties remitted, drawback or bounties received or to be received upon the exportation of the goods.

3. When it is impracticable for the shippers to specify any of such charges because unascertained at the time of shipment, to be paid by the consignee, or for other reasons, such charges may be omitted and the cause of the omission stated.

In the case of goods shipped otherwise than on purchase or agreement to purchase, the invoice must set forth the actual market value in the usual wholesale quantities in the principal markets of the country of exportation at the time of exportation in their condition packed ready for shipment, and shall include or separately specify the cost of inland freight, if any, and packing charges, including boxing, tilloting, cartons, packing, and similar charges.

Electrical Exports from Germany.—The electrical manufacturing industry of Germany occupies the first position from the standpoint of the few industries in that country which have scarcely been detrimentally affected by the generally unfavourable reaction in trade during the past 12 months. This fact is illustrated by the value of the exports in the first half of the present year as compared with the equivalent periods in the preceding years. The figures are as follows, marks being assumed to be equal to shillings:—

	Value of electrical exports.
First half of 1910...	£5,077,000
" " 1911...	4,899,000
" " 1912...	5,119,000
" " 1913...	6,238,000
" " 1914...	7,311,000

As compared with the first half of 1913, the exports in the six months of this year show an increase of 18 per cent., whilst the advance as contrasted with the first half of 1912 is 44 per cent. The principal position of the augmentation applies to material for lighting and power installations, the value of which rose from £1,261,000 in the first half of 1913 to £2,128,000 in that of 1914. The chief customer was Russia, which imported material of twice the weight as compared with the period of 1913. In the case of dynamos of over 10 cwt. in weight, the exports advanced from a value of £749,000 in 1913 to £867,000 this year, Italy being the best customer. The exports of metal-filament lamps rose from 19,540,000 to 20,000,000 lamps, but the cheaper prices prevailing caused the value to decline from £980,000 to £961,000. On the other hand, the number of carbon-filament lamps receded from 4,210,000 to 2,580,000, of which Russia imported about one fourth. The only large reduction took place in cables, which decreased from £913,000 in the first half of 1913 to £845,000 in the corresponding period of the current year.

Railway Electrification and Engine Drivers.—Both the Brighton and South-Western Railway Companies have come to an arrangement with their steam locomotive staffs, whereby the latter will have the first chance of taking up positions as drivers in connection with the railway electrification now taking place on those lines.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this Journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

17,120. "Electric sad-iron." E. A. Welch. July 20th.

17,131. "Methods for producing devices consisting of substances liable to changes in their ohmic resistance under the action of light-sensitive preparations and the like." S. Kahan. July 20th. (N. S. Yapolsky, Russia).

17,133. "Process for electrolytically depositing metal upon metal by means of high current density, specially applicable for coating printing-rollers, hydraulic rams, and other like purposes." T. R. Harris. July 20th.

17,160. "Electric telegraphy." J. Erskine-Murray, and Clark, Forde, Taylor, & Erskine-Murray. July 20th.

17,175. "Process and apparatus for electrically separating suspended bodies from electrically insulating fluids, especially gaseous fluids." E. Moller. July 20th. (Addition to 17,840/12. Convention date, July 22nd, 1913, Germany). (Complete).

17,179. "Regulating-devices for dynamo-electric machines." W. S. Jeal. July 20th.

17,184. "Electrically illuminated signs and the like." C. Roberts. July 20th.

17,246. "Transmission of electrical impulses over circuits of high electrostatic capacity." G. Musso. July 21st. (Complete).

17,256. "Manufacture of cartridge cases." S. O. Cowper-Coles. July 21st.

17,257. "Mandrels for use in the electrolytic production of metal tubes and the like." S. O. Cowper-Coles. July 21st.

17,258. "Means for removing metallic cylinders from mandrels on which they are electro-deposited." S. O. Cowper-Coles. July 21st.

17,259. "Process for the manufacture of hollow iron articles." S. O. Cowper-Coles. July 21st.

17,267. "Controlling devices for the ignition of internal combustion engines." F. H. Royce and Rolls-Royce, Ltd. July 21st. (Complete).

17,317. "Electrical measuring instruments." British Thomson-Houston Co., Ltd. July 21st. (General Electric Co., United States).

17,328. "Means for controlling the heating effect of electric heating apparatus." A. F. Berry. July 21st.

17,329. "Electrical heating apparatus." A. F. Berry. July 21st.

17,331. "Method of and apparatus for, generating high-frequency electric currents." A Heyland. July 21st. (Convention date, August 18th, 1913, Germany). (Complete).

17,332. "Filament for incandescent electric lamps." W. G. Hughes. July 21st. (Complete).

17,345. "Electric heaters." H. Wilson & Co., Ltd., and W. R. Fairbairn. July 22nd.

17,356. "Junction board for electric cables." W. G. Heys. July 22nd. (General Acoustic Co., United States). (Complete).

17,379. "Automatic protective devices or cut-outs for electric circuits." Siemens Schuckertwerke G.m.b.H. July 22nd. (Convention date, July 23rd, 1913, United States). (Complete).

17,391. "Electrical heating apparatus." G. H. Collins and H. F. Collins. July 22nd.

17,392. "Thermo-electric couple to be used for the improvement and cultivation of flowers, plants, shrubs, and the like." F. H. Norris. July 22nd.

17,399. "Telautographic apparatus." A. G. Bloxam. July 22nd. (Telepantograph G.m.b.H., Germany). (Complete).

17,414 "Ignition of internal combustion engines." E. Schulz. July 22nd. (Complete).

17,415. "Automatic or semi-automatic telephone exchange systems." G. A. Betulander and N. G. Palmgren. July 22nd. (Complete).

17,416. "Apparatus for receiving electric signals." Marconi's Wireless Telegraph Co., Ltd., and H. J. Round. July 22nd.

17,424. "Protecting device for the accessories of electric apparatus." W. E. Evans. July 22nd. (Allgemeine Elektricitäts Ges., Germany). (Complete).

17,425. "Furnace electrode." W. E. Evans. July 22nd. (Elektrochemische Werke G.m.b.H., Germany). (Complete).

17,426. "Method of and apparatus for producing flows in the molten masses of electrical furnaces." W. E. Evans. July 22nd. (Elektrochemische Werke G.m.b.H., Germany). (Complete).

17,437. "Junctions or connections for electrical conduits and other pipe connections." H. H. Longbottom and T. Farrar, trading as Steel Tubes and Conduits Co. July 23rd.

17,446. "Telephone systems." M. S. Conner and R. E. Robinson. July 23rd.

17,452. "Electric relays." Eastern Telegraph Co., Ltd., and B. Davies. July 23rd.

17,455. "Means for cooling electro-magnetic friction clutches, and more particularly reversing clutches." Vulcan Maschinenfabrik-Akt. Ges. July 23rd. (Convention date, August 16th, 1913, Austria). (Complete).

17,465. "Control systems for electric motors." N. W. Storer. July 23rd. (Convention date, July 29th, 1913, United States). (Complete).

17,487. "Receiving system for radio telegraphy or telephony." G. O. Squier. July 23rd. (Complete).

17,511. "Electrically-operated fastening for railway-carriage doors and the like." J. E. Crossley. July 24th. (Complete).

17,515. "Means for connecting electrical conduits to their fittings." A. Myers and L. Myers. July 24th.

17,528. "Tubular insulators for high-tension electricity." E. Haefely. July 24th. (Complete).

17,590. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. and A. B. Sperry. July 24th. (Divided Application on 1,970/14. January 24th).

17,593. "Electrical indicating or signalling apparatus." C. Campbell. July 24th.

17,596. "Switches for cinematograph arc lamps." William Butcher and Sons, Ltd., R. E. Gill, & A. A. Lippold. July 24th. (Complete).

17,597. "Packing envelopes and cases for electric batteries and cells." G. F. Hitzelberger and New British Ever Ready Co., Ltd. July 24th. (Complete).

17,600. "Electro-magnetic levitating apparatus." E. Bachelet. July 24th.

17,602. "Controlling devices especially applicable for use with electrically operated printing and stamping machines." M. Rockstroh. July 24th. (Addition to 4,678/10). (Complete).

17,603. "Apparatus for electrocuting animals." E. G. Fairholme and A. D. Clarke. July 24th. (Complete).

17,611. "Apparatus for closing or breaking an electrical current by rise of temperature." N. Bendixen. July 25th.

17,620. "Railway safe-running devices." A. R. Angus. July 25th.

17,628. "Electrical dust suction apparatus." Bunte and Remmler. July 25th. (Convention date, August 29th, 1913, Switzerland). (Complete).

17,646. "Improvements in electric gas lamps." A. Lederer. July 25th. (Addition to 17,036/14, Convention date, July 25th, 1913, Austria). (Complete).

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W. C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

7,545. Electric Switches for the Ignition Systems of Internal-combustion Engines. C. F. Kettering & W. A. Chryst. March 31st. (November 20th, 1912.

13,064. Electric Railway Signal Relay to be Operated by Alternating or Pulsating Currents. A. H. Johnson & W. J. Thorrowgood. June 5th.

15,199. Electric Systems of Ship Propulsion. British Thomson-Houston Co. (General Electric Co.). July 1st.

15,297. Manufacture of Tungsten Bodies, particularly for Electric Incandescent Lamps. F. Simpson. July 2nd. (Cognate Application, 2,612/14).

15,334. Means for Suspending Electric and other Motors for the purpose of Absorbing Vibration. F. S. Boerries. July 3rd.

15,469. Advertising Devices and the like. H. K. Harris. July 4th. (Patent of Addition not granted).

15,561. Telegraphy. R. Lopez & Creed, Bille & Co. July 5th.

15,636. Magnetos. H. Ford. July 7th.

15,675. Apparatus for Checking any Suitable Predetermined Number of Calls at a Telephone Call Box or other place. J. Pinter. July 7th. (July 13th, 1912).

15,783. Sound-transmitting Apparatus. W. H. Derriman. (Automatic Enunciator Co.). July 8th.

15,828. Telephony. S. G. Brown. July 9th.

16,015. Dynamo-electric Machines. H. Lucas & H. E. Moore. July 11th.

16,132. Electric Distant Control Systems. A. Petersen & Kemp and Lauritzen (Firm of). July 12th.

16,268. Means for Duplex Electric Signalling through Land Lines and Cables. A. Orling & Orling's Telegraph Instruments Syndicate, Ltd. July 15th.

16,435. Duplex Telegraphy and the like. H. G. Barwell & Eastern Telegraph Co. July 17th.

16,791. Lamp Hanger for High-tension Series Lighting. G. Barker (Thompson Electric Co.). July 22nd.

17,529. Apparatus for Electrically Igniting Miners' Safety Lamps. V. E. Joyce and Spagnoletti, Ltd. July 30th. (Cognate Application, 20,709/13).

17,712. Blow-outs for Electric Circuits. Siemens Bros. Dynamo Works, Ltd., and R. A. R. Bolton. August 1st.

19,524. Electrical Starters for Internal Combustion Engines. E. V. Hartford. August 28th.

19,985. Gas and Electric Lamps particularly for use on Vehicles. F. R. Swinburne. September 4th.

20,135. Electrical Winches with Continuously Working Motor. G. Garde & Koefoed, Hauberg, Marstrand & Helweg Aktiesekskabet Titan. September 5th.

22,765. Electrically Illuminated Fountains. H. P. Allison. October 8th.

23,498. Temperature Indicating or Recording Systems and Appliances. A. Barry. October 17th.

24,108. Apparatus for Automatically Exhibiting Letters, Signs and other Representations for Advertising and like purposes. J. Coudurier. October 24th.

26,075. Grapnels for Submarine Cables. H. L. Davis. November 13th.

26,340. Hydraulic or Electro-hydraulic Presses. Maschinenfabrik Oerlikon. November 17th. (December 19th, 1912).

27,225. Electric Telegraphs. E. Raymond-Barker. November 26th.

27,599. Method and Apparatus for the Regulation of Gas Pressure in Rontgen Tubes, Vacuum Tubes, and the like. F. A. Lindemann. (December 2nd, 1912). December 1st.

27,852. Method of Maintaining a Dynamo at a Constant Electromotive Force. J. F. J. Bethenod. December 3rd. (December 27th, 1912).

28,376. Telephone Relays and the like. W. Aitken. December 9th.

28,966. Collectors used in Connection with Dynamo-electric Machines. W. P. Thompson (Aktiebolaget Ljungstroms Angturbin). December 16th.

29,824. Current Indicating Devices. F. Smith & Ferranti, Ltd. December 27th.

1914.

389. Protective Arrangements for Electric Circuits. Siemens Schukertwerke Ges. January 6th. (May 10th, 1913).

1,248. Resistance Apparatus for Electric Motor Starters, Rheostats, and the like. W. Geipel & C. J. Margerison. January 16th.

1,548. Telegraphic Printing Receivers. J. B. Nigron. January 20th. (January 21st, 1913)

1,968. Telephonic Receivers. Western Electric Co. (Woodward, acting for Western Electric Co.). January 24th.

2,202. Machines for Winding Wire or other Material of like form. C. B. Snell. January 27th. (February 3rd, 1913).

2,409. Electric Alternating Current Commutator Machines. Siemens-Schuckertwerke Ges. January 29th. (January 30th, 1913).

3,150. High-tension Electric Insulators. A. Watkins. February 6th.

3,594. Current Collectors for Electric Traction Systems. Allgemeine Elektricitäts Ges. February 11th. (February 12th, 1913).

3,868. Bell Signal Indicators. G. J. Black & W. Foggo. February 14th.

4,230. Method of Lighting Intense Current Arcs by Means of Currents of Less Intensity and High Frequency. A. Korn. February 18th.

6,072. Electric Ignition Systems for Internal-combustion Engines. C. F. Kettering & W. A. Chryst. March 10th. (Divided Application on 7,545/13. March 31st. Patent of Addition not granted).

6,097. Telephone Systems. E. A. Graham & W. J. Rickets. March 10th.

6,104. Arc Light Carbons. H. Ayrton. March 10th (Addition to 1,775/13).

6,729. Ignition Timers for Gas Engines. J. T. Pedersen. March 17th.

6,731. Cooling Lower Electrodes for Electrical Smelting Furnaces. Fried Krupp Akt. Ges. March 17th. (December 13th, 1913).

7,938. Electric Installations, particularly applicable to Electric Lighting. R. Despessailles. March 28th. (March 29th, 1913).

9,175. Apparatus for Controlling the Lighting Power of an Electric Lighting Plant. Soc. Anon des Automobiles et Cycles Peugeot. April 11th. (April 10th, 1913).

10,004. Safety-devices for Electrical Circuits. P. Torchio & H. R Woodrow. April 22nd.

10,616. Galvanic Cells. E. Achenbach. April 29th.

11,516. Electric Control Apparatus for Signalling Systems. A. D. Cardwell. May 9th. (Divided Application on 17,439/13. July 29th).

11,644. Metallic Vapour Electric Lamps. Korting & Mathiesen Akt-Ges. May 12th. (May 21st, 1913).

11,937. Electric Heating-apparatus. A. F. Berry. May 14th. (Divided Application on 16,040/13. July 11th).